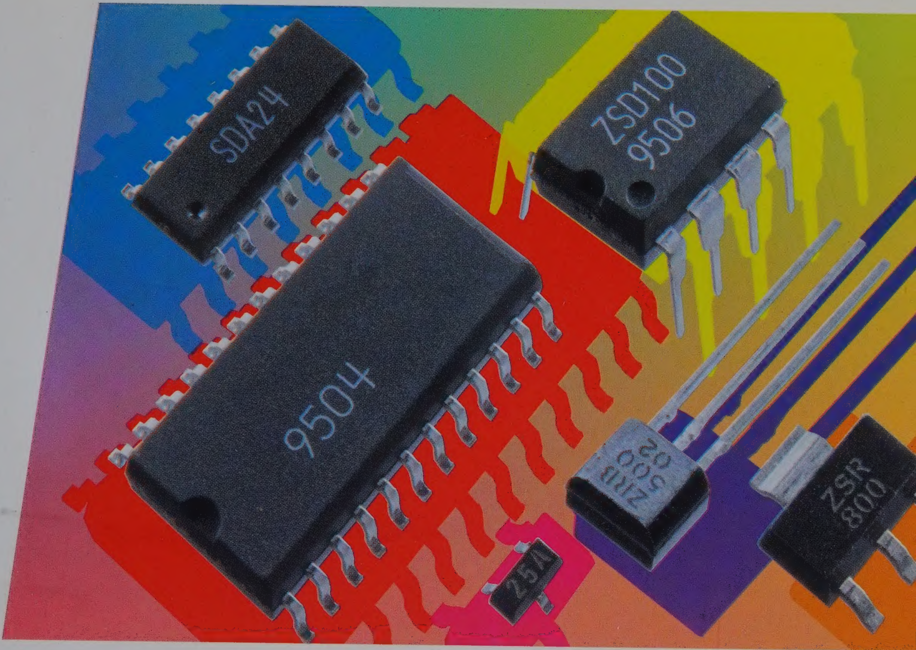
High Performance Linear Bipolar Integrated Circuits


SDA24
ZSD100
9506
9504
ZRB
500
02
ZSR
800
25A

Data Book

- Voltage References
- Voltage Regulators
- Supply Voltage Monitors
- Dual Devices
- Application Specific Standard Products

ZETEX

High Performance Linear Integrated Circuits Data Book

ISSUE 1 JANUARY 1996

TABLE OF CONTENTS

Section
Index
Introduction
Alpha Numeric Index
Cross Reference Guide
Voltage References 1
Voltage Regulators 2
Supply Voltage Monitors 3
Dual Devices 4
Application Specific Standard Products 5
Packaging Information 6
Tape and Reel Information 7

This publication is issued to provide outline information only which (unless agreed by the Company in writing) may not be used, applied or reproduced for any purposes or form part of any order or contract or be regarded as representation relating to the products or services concerned. The company reserves the right to alter without notice the specification, design, price or conditions of supply of any product or service.
Some changes to earlier published data may have been made, data presented in this data book supersedes all previous specifications.
Zetex products are not authorised for use as critical components in life support devices or systems without the express written approval of the Managing Director of Zetex plc. As used herein -

a. Life support devices or systems are devices or systems which (1) are intended to implant into the body, or (2) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labelling can be reasonably expected to result in significant injury to the user.

b. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

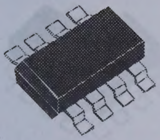
Zetex does not assume any liability arising from the use or application of any product or circuit described in this publication.

E. & O. E.

"all rights reserved"

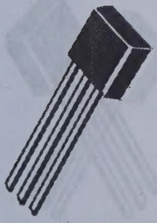
Index

PAGE



Section 1 Voltage References

	Introduction	1-1
	Ordering Information	1-2
	Package Connection Diagrams	1-8
ZR285	2.5 volt low knee current reference	1-9
ZR4040-2.5	2.5 volt reference	1-12
ZR4040-4.1	4.1 volt reference	1-15
ZR4040-5.0	5.0 volt reference	1-18
ZRA124	1.24 volt 1% tolerance reference	1-21
ZRA125	1.25 volt reference	1-24
ZRA245	2.45 volt reference	1-27
ZRA250	2.5 volt reference	1-30
ZRA400	4.1 volt reference	1-33
ZRB500	5.0 volt reference	1-36
ZRC250	2.5 volt low knee current reference	1-39
ZRC330	3.3 volt low knee current reference	1-42
ZRC400	4.1 volt low knee current reference	1-45
ZRC500	5.0 volt low knee current reference	1-47
ZRT025	2.5 volt trimmable reference	1-49
ZRT040	4.1 volt trimmable reference	1-52
ZRT050	4.9 volt trimmable reference	1-55
ZRT062	6.17 volt trimmable reference	1-58
ZRT100	9.8 volt trimmable reference	1-61

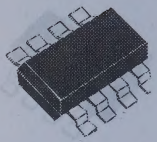


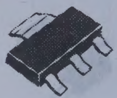
Section 2 Voltage Regulators

	Introduction	2-1
	Ordering Information	2-3
	Package Connection Diagrams	2-5
ZMR250	2.5 volt SOT23 regulator	2-7
ZMR500	5.0 volt SOT23 regulator	2-7
ZR431	Programmable regulator (2.5V+)	2-12
ZR2431	Programmable regulator (1.25V+)	2-18
ZSR285	2.85 volt, 200mA regulator	2-29
ZSR300	3.0 volt, 200mA regulator	2-29
ZSR330	3.3 volt, 200mA regulator	2-21
ZSR400	4.0 volt, 200mA regulator	2-29
ZSR500	5.0 volt, 200mA regulator	2-21
ZSR570	5.7 volt, 200mA regulator	2-29
ZSR600	6.0 volt, 200mA regulator	2-21
ZSR800	8.0 volt, 200mA regulator	2-21
ZSR900	9.0 volt, 200mA regulator	2-29

Section 2 Voltage Regulators (Continued)

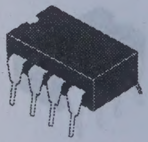
		PAGE
ZSR1000	10.0 volt, 200mA regulator	2-21
ZR78L028	2.85 volt, 200mA regulator	2-44
ZR78L03	3.0 volt, 200mA regulator	2-44
ZR78L033	3.3 volt, 200mA regulator	2-37
ZR78L04	4.0 volt, 200mA regulator	2-44
ZR78L05	5.0 volt, 200mA regulator	2-37
ZR78L057	5.7 volt, 200mA regulator	2-44
ZR78L06	6.0 volt, 200mA regulator	2-37
ZR78L08	8.0 volt, 200mA regulator	2-37
ZR78L09	9.0 volt, 200mA regulator	2-44
ZR78L10	10.0 volt, 200mA regulator	2-37
ZSAT500	5.0 volt, enhanced regulator	2-51
ZLDO330	3.3 volt, ultra low dropout regulator	2-57
ZLDO485	4.85 volt, ultra low dropout regulator	2-65
ZLDO500	5.0 volt, ultra low dropout regulator	2-73





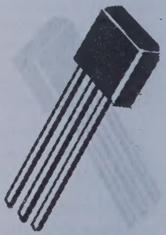
Section 3 Supply Voltage Monitors

	Introduction	3-1
	Ordering Information	3-2
	Package Connection Diagrams	3-3
ZSM300	2.63 volt threshold monitor	3-5
ZSM330	3.1 volt threshold monitor	3-9
ZSM530	4.3 volt threshold monitor	3-13
ZSM560	4.6 volt threshold monitor	3-17
ZSM561	Zener limitted,4.6 volt threshold monitor	3-21
ZM33064	4.6 volt threshold monitor	3-26
ZM33164	4.3 volt threshold monitor	3-30
ZM33164-3	2.68 volt threshold monitor	3-34



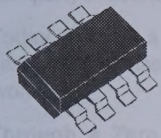
Section 4 Dual Devices (¤ = connection options, see data sheet)

	Introduction	4-1
	Ordering Information	4-4
	Package Connection Diagrams	4-6
ZRA¤1212	Dual 1.25 volt reference	4-7
ZRA¤2525	Dual 2.5 volt reference	4-8
ZRA¤4040	Dual 4.0 volt reference	4-9
ZRB¤5050	Dual 5.0 volt reference	4-10
ZRC¤3333	Dual 3.3 volt reference	4-11
ZS¤D5033	5 and 3.3 volt regulator combination	4-12
ZS¤D5030	5 and 3 volt regulator combination	4-13
ZRD¤431	Dual programmable regulator (2.5V+)	4-14
ZRD¤2431	Dual programmable regulator (1.25V+)	4-15
ZSMD5633	4.6 and 3.08 volt threshold monitor	4-16



Section 4 Dual Devices(Continued) PAGE

ZSMD5630 4.6 and 2.63 volt threshold monitor 4-17
ZSMD5333 4.3 and 3.08 volt threshold monitor 4-18
ZSMD5330 4.3 and 2.63 volt threshold monitor 4-19
ZRSM5060 5 volt regulator and 4.6 volt monitor 4-20
ZRSM5030 5 volt regulator and 4.3 volt monitor 4-21
ZRSM3333 3.3 volt regulator and 3.08 volt monitor 4-22
ZRSM3030 3 volt regulator and 2.63 volt monitor 4-23



Section 5 Application Specific Standard Products

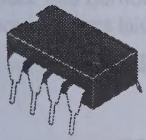
Introduction 5-1
Ordering Information 5-2
Package Connection Diagrams 5-3
ZSD100 Siren driver IC 5-5
SDA24 Schottky diode array 5-12
AN16 Siren driver application note 5-15
DN23 Schottky array design note 5-21

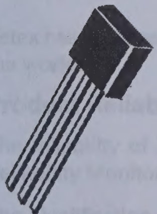
Section 6 Packaging Information

Through hole package dimensions 6-2
Surface mount package dimensions 6-5

Section 7 Tape and Reel Information

Through hole tape and reel specifications 7-2
Surface mount tape and reel specifications 7-3





Introduction

Quality and Performance You Can Trust

Zetex boasts a remarkable pedigree in the manufacture of analogue components. For over thirty years, innovation and excellence have been our hallmarks and a succession of world firsts characterise the company's record.

Today, through a commitment to Total Quality Management and to the provision of a first class service, Zetex has established itself as the preferred vendor to thousands of companies around the world.

Through a Zero Defect production programme and a technical support service which is second-to-none, customers requiring small quantity, high specification components can expect the same attentive care as those making high volume demands.

Inherently designed-in product quality is supported by SPC, ESD, FMEA and PPM programs on all product lines, whilst Delivery On Time remains a central objective.

It is no surprise, then, that the trust and respect of customers have set Zetex apart from its competitors. Product specification, and an outstanding record of reliability has ensured that "customer satisfaction" is a consistent feature of Zetex's performance.

Today, Zetex can boast an international network of expertise, offering technical support to specialist manufacturers all over the world.

An outstanding service. Performance you can trust.

Quality Approvals

Zetex has demonstrated during extensive audits that all areas of its quality system have met the requirements laid down by international bodies.

BS EN ISO 9001	- International specifications for design development, production, installation and servicing.
BS9000	- British component approvals.
CECC 50000	- European component approvals.
IECQ 700000	- International component approvals.

Zetex has also been awarded many individual component approvals by major companies throughout the world.

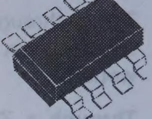
Product Reliability

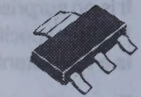
The reliability of Zetex product is ensured by a Qualification Program and an on-going Product Reliability Monitoring Program.

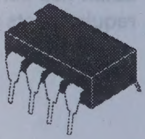
The Qualification Program is used to prove the reliability of new devices and packages whilst the Product Reliability Monitoring Program is designed to continually assess the reliability of all Zetex products by randomly selecting them (against a pre-defined program) from the production line.

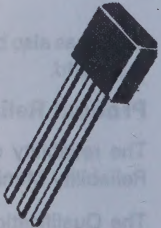
Alpha-Numeric Index

Part Number	Page No
SDA24	5-12
ZLDO330	2-57
ZLDO485	2-65
ZLDO500	2-73
ZM33064	3-26
ZM33164	3-30
ZM33164-3	3-34
ZMR250	2-7
ZMR500	2-7
ZR2431	2-18
ZR285	1-9
ZR4040-2.5	1-12
ZR4040-4.1	1-15
ZR4040-5.0	1-18
ZR431	2-12
ZR78L028	2-44
ZR78L03	2-44
ZR78L033	2-37
ZR78L04	2-44
ZR78L05	2-37
ZR78L057	2-44
ZR78L06	2-37
ZR78L08	2-37
ZR78L09	2-44
ZR78L10	2-37
ZRA124	1-21
ZRA125	1-24
ZRA245	1-27
ZRA250	1-30
ZRA400	1-33
ZRA¤1212	4-7
ZRA¤2525	4-8
ZRA¤4040	4-9
ZRB500	1-36
ZRB¤5050	4-10
ZRC250	1-39
ZRC330	1-42
ZRC400	1-45
ZRC500	1-47
ZRC¤3333	4-11
ZRD¤2431	4-15
ZRD¤431	4-14
ZRSM3030	4-23
ZRSM3333	4-22
ZRSM5030	4-21
ZRSM5060	4-20
ZRT025	1-49
ZRT040	1-52
ZRT050	1-55
ZRT062	1-58
ZRT100	1-61
ZSAT500	2-51
ZSD100	5-5
ZSM300	3-5
ZSM330	3-9
ZSM530	3-13
ZSM560	3-17
ZSM561	3-21
ZSMD5330	4-19
ZSMD5333	4-18
ZSMD5630	4-17
ZSMD5633	4-16
ZSR1000	2-21
ZSR285	2-29
ZSR300	2-29
ZSR330	2-21
ZSR400	2-29
ZSR500	2-21
ZSR570	2-29
ZSR600	2-21
ZSR800	2-21
ZSR900	2-29
ZS¤D5030	4-13
ZS¤D5033	4-12









(Note: ¤ = connection options, see datasheet)

Note: These devices represent nearest equivalents to Zetex products.
There may be specification differences between devices

References

Part No	Manufacturer	Zetex Ind Std No	Zetex Part No
LM136-5	NSC		ZRB500
LM136-2.5	NSC/Lin Tech		ZRA250
LM185-1.2	NCS/Lin Tech/Mot		ZRA124/125
LM185-2.5	NSC/Lin Tech	ZR285-2.5	
LM236-2.5	NSC/Lin Tech/SGS/TI		ZRA250
LM236-5	NSC		ZRB500
LM285-1.2	NCS/Lin Tech/Mot		ZRA124/125
LM285-2.5	NSC/Lin Tech/Mot/TI	ZR285-2.5	
LM336-2.5	NSC/Lin Tech/SGS/TI		ZRA250
LM336-5	NSC		ZRB500
LM385-1.2	NCS/Lin Tech/Mot		ZRA124/125
LM385-2.5	NSC/Lin Tech/Mot/TI	ZR285-2.5	
LM4040-2.5	NSC/Micrel	ZR4040-2.5	
LM4040-4.1	NSC/Micrel	ZR4040-4.1	
LM4040-5.0	NSC/Micrel	ZR4040-5	
LM4041-1.2	Micrel		ZRA124/125
REF12	GPS		ZRA124/125
REF25	GPS		ZRA250
REF50	GPS		ZRB500
SR12D	GPS		ZRA124/125
SR25D	GPS		ZRA250
SR50D	GPS		ZRB500
ZN404	GPS		ZRA245
ZN423	GPS		ZRA124/125
ZN458	GPS		ZRA245
ZNREF025	GPS		ZRT025
ZNREF040	GPS		ZRT040
ZNREF050	GPS		ZRT050
ZNREF062	GPS		ZRT062
ZNREF100	GPS		ZRT100

Cross Reference Guide(Continued)

Regulators

Part No	Manufacturer	Zetex Ind Std No
HA178L05	Hitachi	ZR78L05
HA178L08	Hitachi	ZR78L08
HA178L09	Hitachi	ZR78L09
HA178L10	Hitachi	ZR78L10
L78L05	SGS-T	ZR78L05
LM431	NSC	ZR431
LM78L05	NSC	ZR78L05
LM78L09	NSC	ZR78L09
MC78L05	Mot	ZR78L05
MC78L08	Mot	ZR78L08
TA78L008	Tosh	ZR78L08
TA78L009	Tosh	ZR78L09
TA78L10	Tosh	ZR78L10
TL431	TI/Lin Tech/Mot	ZR431
UA78L05	TI	ZR78L05
UA78L08	TI	ZR78L08
UA78L09	TI	ZR78L09
UA78L10	TI	ZR78L10

Supply Monitors

Part No	Manufacturer	Zetex Ind Std No	Zetex Part No
MC33064	Mot	ZM33064	
MC33164-3	Mot	ZM33164-3	
MC33164-5	Mot	ZM33164	
RE5VA**AC	Ricoh		ZSM Series
TL7757	TI		ZSM560

Section 1

Voltage References

This range of devices features low minimum operating currents, down to 20μA for the ZRC and ZR285 series devices, and selection of almost any reference voltage between 1.25 and 10 volts. Tolerances are generally between 1% and 3%, precision trimming is possible with the ZRT series. Low temperature coefficients are offered with 50ppm/°C maximum on many of the devices. Stabilising capacitors are not required for any of these devices. 5mA is typical of the maximum current specified for these devices, however it is possible to offer extended operating current ranges for most products. Package options for these devices include SOT23, SOT223 and SO8 for surface mount requirements as well as Zetex E-Line (both forward and reverse connected) for through hole applications.

Selection guide

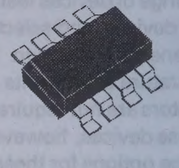
Part No	Reverse Breakdown Voltage (V)	Minimum Current (μA)	Maximum Current (mA)	Maximum Temperature Coefficient (ppm/°C)	Maximum Slope Resistance (Ω)
ZR285	2.5	20	20	90	1
ZR4040-2.5	2.5	50	20	90	2
ZR4040-4.1	4.096	50	20	90	2
ZR4040-5.0	5	50	20	90	1.5
ZRA124	1.24	50	5	90	2
ZRA125	1.25	50	5	90	2
ZRA245	2.45	2000	120	50	0.5
ZRA250	2.5	50	5	90	2
ZRA400	4.096	50	5	50	2
ZRB500	5	50	5	50	1.5
ZRC250	2.5	20	5	60	2
ZRC330	3.3	20	5	50	2
ZRC400*	4.096	25	5	60	2
ZRC500*	5	25	5	60	2
ZRT025	2.5	150	75	50	2
ZRT040	4.096	150	75	50	3
ZRT050	4.9	150	60	50	2
ZRT062	6.17	150	50	40	3
ZRT100	9.8	150	30	50	4

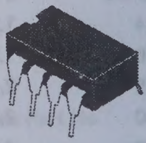
* Advanced Information

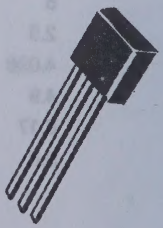
Voltage Reference Ordering Information

R = alternative pinning

Part Number	Tol %	Package	Part Mark
ZR285N802	2	SO8	ZR28502
ZR285F02	2	SOT23	28B
ZR285R02	2	E-line, 3pin, R	ZR28502
ZR285Y02	2	E-line, 2pin	ZR28502
ZR285N803	3	SO8	ZR28503
ZR285F03	3	SOT23	28A
ZR285R03	3	E-line, 3pin, R	ZR28503
ZR285Y03	3	E-line, 2pin	ZR28503
ZR40401N825	1	SO8	ZR4040125
ZR40401F25	1	SOT23	25M
ZR40401R25	1	E-line, 3pin, R	ZR4040125
ZR40402N825	2	SO8	ZR4040225
ZR40402F25	2	SOT23	25L
ZR40402R25	2	E-line, 3pin, R	ZR4040225
ZR40401N841	1	SO8	ZR4040141
ZR40401F41	1	SOT23	40F
ZR40401R41	1	E-line, 3pin, R	ZR4040141
ZR40402N841	2	SO8	ZR4040241
ZR40402F41	2	SOT23	40E
ZR40402R41	2	E-line, 3pin, R	ZR4040241
ZR40401N850	1	SO8	ZR4040150
ZR40401F50	1	SOT23	50M
ZR40401R50	1	E-line, 3pin, R	ZR4040150
ZR40402N850	2	SO8	ZR4040250
ZR40402F50	2	SOT23	50L
ZR40402R50	2	E-line, 3pin, R	ZR4040250
ZRA124N801	1	SO8	ZRA12401
ZRA124F01	1	SOT23	12C
ZRA124A01	1	E-line, 3pin	ZRA12401
ZRA124R01	1	E-line, 3pin, R	ZRA124R1
ZRA124Y01	1	E-line, 2pin	ZRA12401
ZRA125N801	1	SO8	ZRA12501
ZRA125F01	1	SOT23	12D
ZRA125A01	1	E-line, 3pin	ZRA12501
ZRA125R01	1	E-line, 3pin, R	ZRA125R1
ZRA125Y01	1	E-line, 2pin	ZRA12501
ZRA125N802	2	SO8	ZRA12502

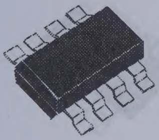


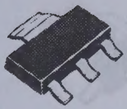


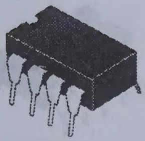


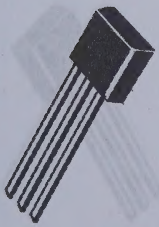
Voltage Reference Ordering Information (continued)

R = alternative pinning







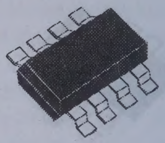


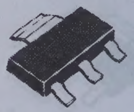
Part Number	Tol %	Package	Part Mark
ZRA125F02	2	SOT23	12B
ZRA125A02	2	E-line, 3pin	ZRA12502
ZRA125R02	2	E-line, 3pin, R	ZRA125R2
ZRA125Y02	2	E-line, 2pin	ZRA12502
ZRA125N803	3	SO8	ZRA12503
ZRA125F03	3	SOT23	12A
ZRA125A03	3	E-line, 3pin	ZRA12503
ZRA125R03	3	E-line, 3pin, R	ZRA125R3
ZRA125Y03	3	E-line, 2pin	ZRA12503
ZRA245N801	1	SO8	ZRA24501
ZRA245F01	1	SOT23	24C
ZRA245A01	1	E-line, 3pin	ZRA24501
ZRA245R01	1	E-line, 3pin, R	ZRA245R1
ZRA245Y01	1	E-line, 2pin	ZRA24501
ZRA245N802	2	SO8	ZRA24502
ZRA245F02	2	SOT23	24B
ZRA245A02	2	E-line, 3pin	ZRA24502
ZRA245R02	2	E-line, 3pin, R	ZRA245R2
ZRA245Y02	2	E-line, 2pin	ZRA24502
ZRA245N803	3	SO8	ZRA24503
ZRA245F03	3	SOT23	24A
ZRA245A03	3	E-line, 3pin	ZRA24503
ZRA245R03	3	E-line, 3pin, R	ZRA245R3
ZRA245Y03	3	E-line, 2pin	ZRA24503
ZRA250N801	1	SO8	ZRA25001
ZRA250F01	1	SOT23	25B
ZRA250A01	1	E-line, 3pin	ZRA25001
ZRA250R01	1	E-line, 3pin, R	ZRA25R1
ZRA250Y01	1	E-line, 2pin	ZRA25001
ZRA250N802	2	SO8	ZRA25002
ZRA250F02	2	SOT23	25C
ZRA250A02	2	E-line, 3pin	ZRA25002
ZRA250R02	2	E-line, 3pin, R	ZRA25R2
ZRA250Y02	2	E-line, 2pin	ZRA25002
ZRA250N803	3	SO8	ZRA25003
ZRA250F03	3	SOT23	25A
ZRA250A03	3	E-line, 3pin	ZRA25003

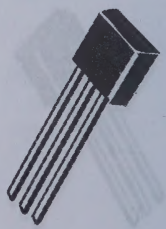
Voltage Reference Ordering Information (continued)

R = alternative pinning

Part Number	Tol %	Package	Part Mark
ZRA250R03	3	E-line 3pin, R	ZRA25R3
ZRA250Y03	3	E-line, 2pin	ZRA25003
ZRA400N801	1	SO8	ZRA40001
ZRA400F01	1	SOT23	40C
ZRA400A01	1	E-line, 3pin	ZRA40001
ZRA400R01	1	E-line, 3pin, R	ZRA4R1
ZRA400Y01	1	E-line, 2pin	ZRA40001
ZRA400N802	2	SO8	ZRA40002
ZRA400F02	2	SOT23	40B
ZRA400A02	2	E-line, 3pin	ZRA40002
ZRA400R02	2	E-line, 3pin, R	ZRA4R2
ZRA400Y02	2	E-line, 2pin	ZRA40002
ZRA400N803	3	SO8	ZRA40003
ZRA400F03	3	SOT23	40A
ZRA400A03	3	E-line, 3pin	ZRA40003
ZRA400R03	3	E-line, 3pin, R	ZRA4R3
ZRA400Y03	3	E-line, 2pin	ZRA40003
ZRB500N801	1	SO8	ZRB50001
ZRB500F01	1	SOT23	50I
ZRB500A01	1	E-line, 3pin	ZRB50001
ZRB500R01	1	E-line, 3pin, R	ZRB5R1
ZRB500Y01	1	E-line, 2pin	ZRB50001
ZRB500N802	2	SO8	ZRB50002
ZRB500F02	2	SOT23	50H
ZRB500A02	2	E-line, 3pin	ZRB50002
ZRB500R02	2	E-line, 3pin, R	ZRB5R2
ZRB500Y02	2	E-line, 2pin	ZRB50002
ZRB500N803	3	SO8	ZRB50003
ZRB500F03	3	SOT23	50G
ZRB500A03	3	E-line, 3pin	ZRB50003
ZRB500R03	3	E-line, 3pin, R	ZRB5R3
ZRB500Y03	3	E-line, 2pin	ZRB50003
ZRC250N802	2	SO8	ZRC25002
ZRC250F02	2	SOT23	25H
ZRC250A02	2	E-line, 3pin	ZRC25002

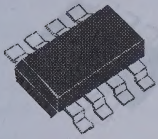


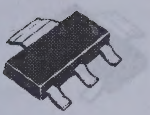


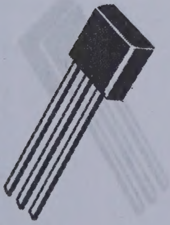


Voltage Reference Ordering Information (continued)

R = alternative pinning





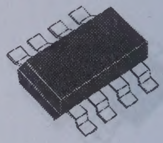


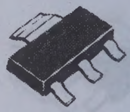
Part Number	Tol %	Package	Part Mark
ZRC250R02	2	E-line, 3pin, R	ZRC25R2
ZRC250Y02	2	E-line, 2pin	ZRC25002
ZRC250N803	3	SO8	ZRC25003
ZRC250F03	3	SOT23	25G
ZRC250A03	3	E-line, 3pin	ZRC25003
ZRC250R03	3	E-line, 3pin, R	ZRC25R3
ZRC250Y03	3	E-line, 2pin	ZRC25003
ZRC330N801	1	SO8	ZRC33001
ZRC330F01	1	SOT23	33C
ZRC330A01	1	E-line, 3pin	ZRC33001
ZRC330R01	1	E-line, 3pin, R	ZRC33R1
ZRC330Y01	1	E-line, 2pin	ZRC33001
ZRC330N802	2	SO8	ZRC33002
ZRC330F02	2	SOT23	33B
ZRC330A02	2	E-line, 3pin	ZRC33002
ZRC330R02	2	E-line, 3pin, R	ZRC33R2
ZRC330Y02	2	E-line, 2pin	ZRC33002
ZRC330N803	3	SO8	ZRC33003
ZRC330F03	3	SOT23	33A
ZRC330A03	3	E-line, 3pin	ZRC33003
ZRC330R03	3	E-line, 3pin, R	ZRC33R3
ZRC330Y03	3	E-line, 2pin	ZRC33003
ZRC400N801	1	SO8	ZRC40001
ZRC400F01	1	SOT23	40F
ZRC400A01	1	E-line, 3pin	ZRC40001
ZRC400R01	1	E-line, 3pin, R	ZRC4R1
ZRC400Y01	1	E-line, 2pin	ZRC40001
ZRC400N802	2	SO8	ZRC40002
ZRC400F02	2	SOT23	40E
ZRC400A02	2	E-line, 3pin	ZRC40002
ZRC400R02	2	E-line, 3pin, R	ZRC4R2
ZRC400Y02	2	E-line, 2pin	ZRC40002
ZRC400N803	3	SO8	ZRC40003
ZRC400F03	3	SOT23	40D

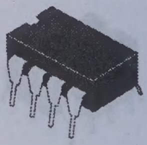
Voltage Reference Ordering Information (continued)

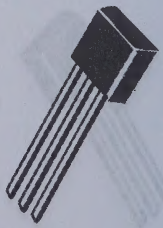
R = alternative pinning

Part Number	Tol %	Package	Part Mark
ZRC400A03	3	E-line,3pin	ZRC40003
ZRC400R03	3	E-line, 3pin, R	ZRC4R3
ZRC400Y03	3	E-line, 2pin	ZRC40003
ZRC500N801	1	SO8	ZRC50001
ZRC500F01	1	SOT23	50M
ZRC500A01	1	E-line, 3pin	ZRC50001
ZRC500R01	1	E-line, 3pin, R	ZRC5R1
ZRC500Y01	1	E-line, 2pin	ZRC50001
ZRC500N802	2	SO8	ZRC50002
ZRC500F02	2	SOT23	50L
ZRC500A02	2	E-line, 3pin	ZRC50002
ZRC500R02	2	E-line, 3pin, R	ZRC5R2
ZRC500Y02	2	E-line, 2pin	ZRC50002
ZRC500N803	3	SO8	ZRC50003
ZRC500F03	3	SOT23	50K
ZRC500A03	3	E-line, 3pin	ZRC50003
ZRC500R03	3	E-line, 3pin, R	ZRC5R3
ZRC500Y03	3	E-line, 2pin	ZRC50003
ZRT025N8A1	1	SO8	ZRT025A1
ZRT025N8C1	1	SO8	ZRT025C1
ZRT025N8C2	2	SO8	ZRT025C2
ZRT025GA1	1	SOT223	ZRT025A1
ZRT025GC1	1	SOT223	ZRT025C1
ZRT025GC2	2	SOT223	ZRT025C2
ZRT025A1	1	TO18	ZRT025A1
ZRT025C1	1	TO18	ZRT025C1
ZRT025C2	2	TO18	ZRT025C2
ZRT040N8A1	1	SO8	ZRT040A1
ZRT040N8C1	1	SO8	ZRT040C1
ZRT040N8C2	2	SO8	ZRT040C2
ZRT040GA1	1	SOT223	ZRT040A1
ZRT040GC1	1	SOT223	ZRT040C1
ZRT040GC2	2	SOT223	ZRT040C2
ZRT040A1	1	TO18	ZRT040A1
ZRT040C1	1	TO18	ZRT040C1
ZRT040C2	2	TO18	ZRT040C2
ZRT050N8A1	1	SO8	ZRT050A1



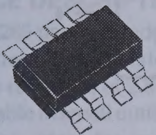


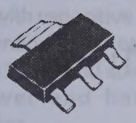


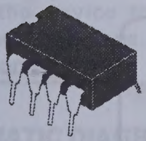


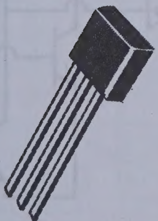
Voltage Reference Ordering Information (continued)

Part Number	Tol %	Package	Part Mark
ZRT050N8C1	1	SO8	ZRT050C1
ZRT050N8C2	2	SO8	ZRT050C2
ZRT050GA1	1	SOT223	ZRT050A1
ZRT050GC1	1	SOT223	ZRT050C1
ZRT050GC2	2	SOT223	ZRT050C2
ZRT050A1	1	TO18	ZRT050A1
ZRT050C1	1	TO18	ZRT050C1
ZRT050C2	2	TO18	ZRT050C2
ZRT062N8A1	1	SO8	ZRT062A1
ZRT062N8C1	1	SO8	ZRT062C1
ZRT062N8C2	2	SO8	ZRT062C2
ZRT062GA1	1	SOT223	ZRT062A1
ZRT062GC1	1	SOT223	ZRT062C1
ZRT062GC2	2	SOT223	ZRT062C2
ZRT062A1	1	TO18	ZRT062A1
ZRT062C1	1	TO18	ZRT062C1
ZRT062C2	2	TO18	ZRT062C2
ZRT100N8A1	1	SO8	ZRT100A1
ZRT100N8C1	1	SO8	ZRT100C1
ZRT100N8C2	2	SO8	ZRT100C2
ZRT100GA1	1	SOT223	ZRT100A1
ZRT100GC1	1	SOT223	ZRT100C1
ZRT100GC2	2	SOT223	ZRT100C2
ZRT100A1	1	TO18	ZRT100A1
ZRT100C1	1	TO18	ZRT100C1
ZRT100C2	2	TO18	ZRT100C2



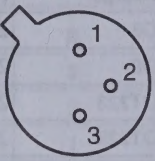






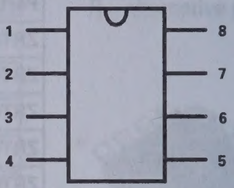
Voltage Reference Connection Diagrams

TO18 Package Suffix – None



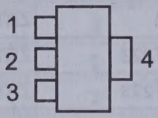
Bottom View –
Case is internally connected to pin 3

SO8 Package Suffix – N8



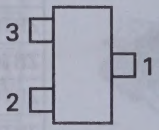
Top View

SOT223 Package Suffix – G



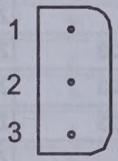
Top View –
Pin 4 floating or connected to pin 2

SOT23 Package Suffix – F



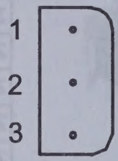
Top View –
Pin 1 floating or connected to pin 2

E-Line, 3 pin Package Suffix – A



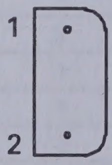
Bottom View –
Pin 1 floating or connected to pin 3

E-Line, 3 pin, Rev Package Suffix – R



Bottom View –
Pin 3 floating or connected to pin 1

E-Line, 2 pin Package Suffix – Y



Bottom View

PRECISION 2.5 VOLT MICROPOWER VOLTAGE REFERENCE

ZR285-2.5

ISSUE 3 – APRIL 1995

DEVICE DESCRIPTION

The ZR285 uses a bandgap circuit design to achieve a precision micropower voltage reference of 2.5 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZR285 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZR285 is recommended for operation between 20µA and 20mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to an absolute maximum of 30mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

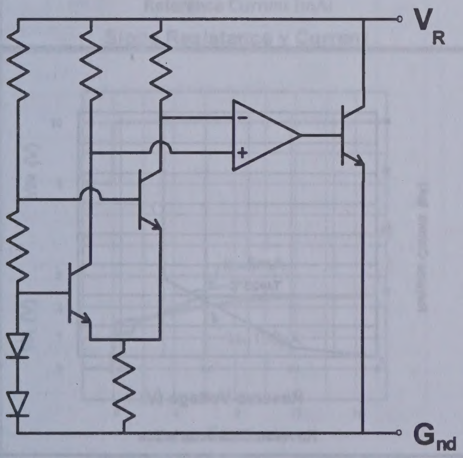
FEATURES

- Small outline SOT23 and SO8 packages
- TO92 style packages
- No stabilising capacitor required
- Low knee current, 15µA typical
- Typical T_C 30ppm/°C
- Typical slope resistance 0.4Ω
- ± 3% and 2% tolerance
- Industrial temperature range
- Operating current 20µA to 20mA

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 2 pin	E-LINE 3 pin R
1	N/C	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R
3	N/C	V_R	-	-
4	G_{nd}	–	–	–
5	N/C	–	–	–
6	N/C	–	–	–
7	N/C	–	–	–
8	V_R	–	–	–
Pack	N8	F	Y	R

see Diagrams Page 1 - 8

ZR285-2.5

ABSOLUTE MAXIMUM RATING

Reverse Current	30mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

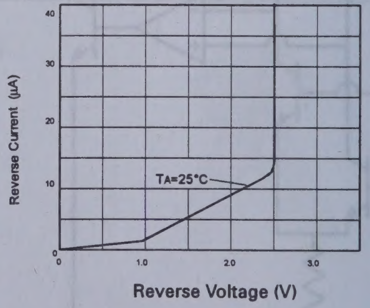
SO8	625mW
SOT23	330mW
E-Line,2 Pin(TO92)	500mW
E-Line,3 Pin(TO92)	500mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150µA	2.45 2.425	2.5 2.5	2.55 2.575	2 3	V
I_{MIN}	Minimum Operating Current			13	20		µA
I_R	Recommended Operating Current		0.02		20		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	I_R = 1mA to 20mA		30	90		ppm/°C
R_S §	Slope Resistance			0.4	1		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.3	0.8		Ω
E_N	Wideband Noise Voltage	I_R = 150µA f = 10Hz to 10kHZ		43			µV (rms)

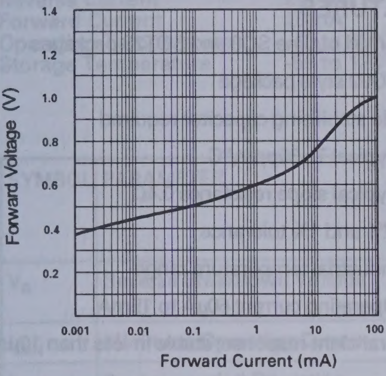
† $$T_C = \frac{V_R\ Change\ \times 1000000}{V_R \times Temperature\ \ Change}$$

§ $$R_S = \frac{V_R\ Change\ \ (I_R\,(min)\ to\ I_R\,(max))}{I_R\,(max) - I_R\,(min)}$$

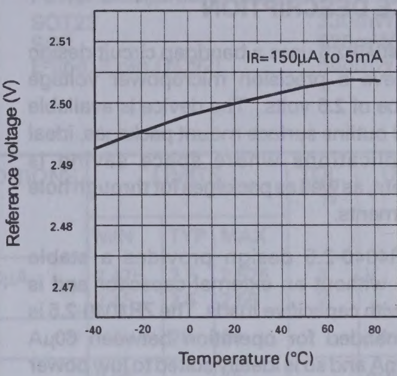


Reverse Characteristics

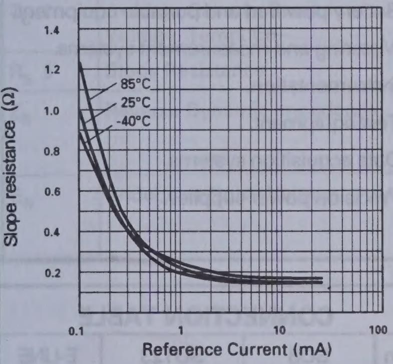
TYPICAL CHARACTERISTICS



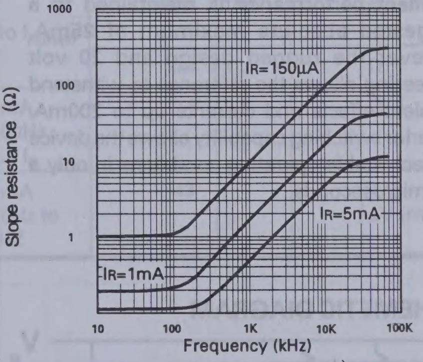
Forward Characteristics



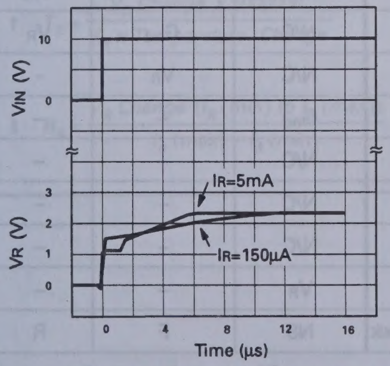
Temperature Drift



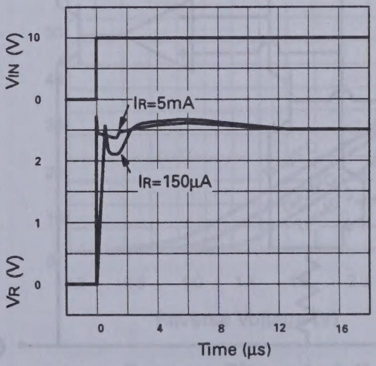
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response - Single pulse



Transient Response - Repetitive Test

PRECISION 2.5 VOLT MICROPOWER VOLTAGE REFERENCE

ZR4040-2.5

ISSUE 1 - JULY 1995

DEVICE DESCRIPTION

The ZR4040-2.5 uses a bandgap circuit design to achieve a precision micropower voltage reference of 2.5 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZR4040-2.5 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZR4040-2.5 is recommended for operation between 60µA and 15mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

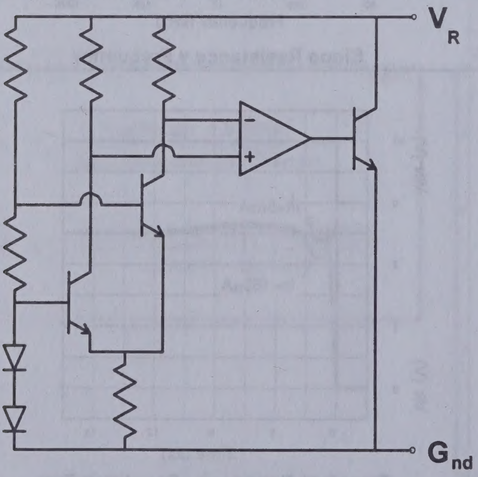
FEATURES

- Small outline SO8 and SOT23 packages
- TO92 style package
- No stabilising capacitor required
- Typical T_C 30ppm/°C
- Typical slope resistance 0.4Ω
- 2% and 1% tolerance
- Industrial temperature range
- Operating current 60µA to 15mA
- Transient response, stable in less than 10µs

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.

SCHEMETIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin R
1	N/C	-	G_{nd}
2	N/C	G_{nd}	V_R
3	N/C	V_R	-
4	G_{nd}	–	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	V_R	–	–
Pack	N8	F	R
see Diagrams Page 1 - 8			

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

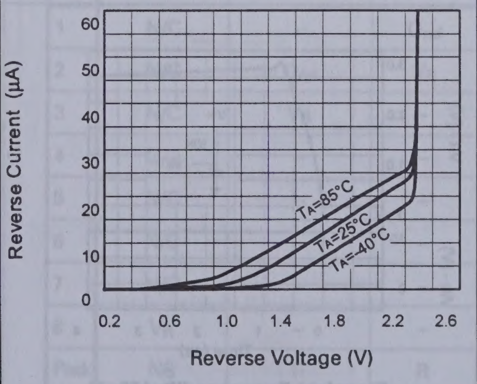
Power Dissipation (T_{amb}=25°C)

SOT23	330mW
SO8	625mW
E-line, 3 pin (TO92)	500mW

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150µA	2.475 2.45	2.5 2.5	2.525 2.55	1 2	V
I_{MIN}	Minimum Operating Current			25	60		µA
I_R	Recommended Operating Current		0.06		15		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		30	100		ppm/°C
R_S §	Slope Resistance			0.4	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.3	0.8		Ω
E_N	Wideband Noise Voltage	I_R = 1mA f = 10Hz to 10kHZ		43			µV (rms)

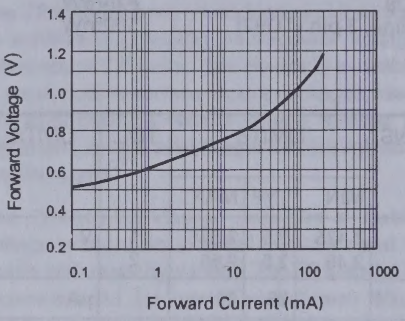
$$† \quad T_C = \frac{V_R \text{ Change } \times 1000000}{V_R \times \text{Temperature Change}}$$

$$§ \quad R_S = \frac{V_R \text{ Change } (I_R(min) \text{ to } I_R(max))}{I_R(max) - I_R(min)}$$

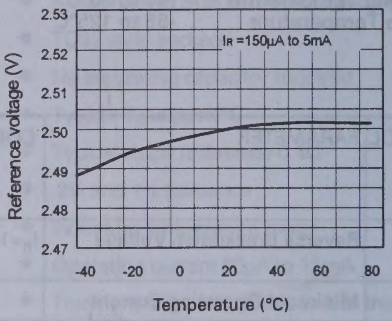


Reverse Characteristics

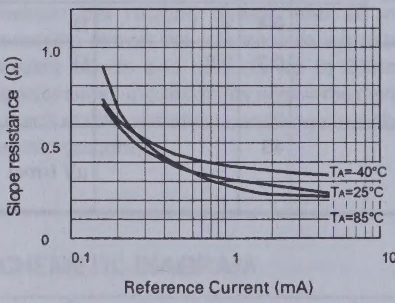
TYPICAL CHARACTERISTICS



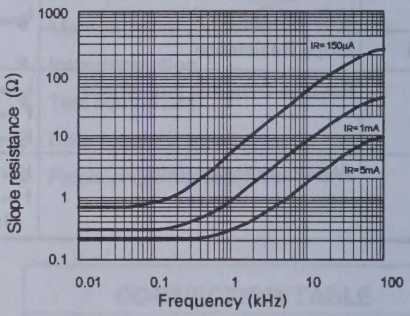
Forward Characteristics



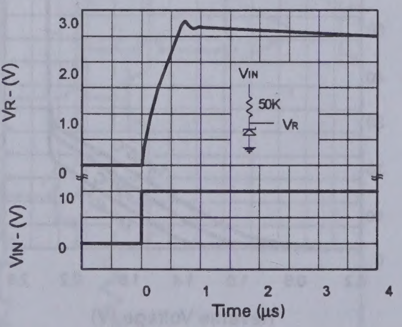
Temperature Drift



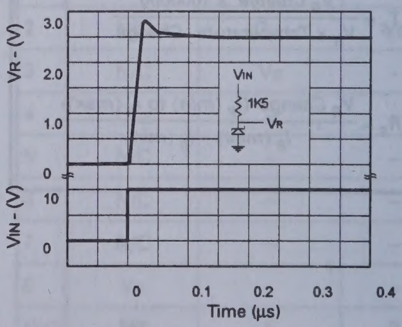
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response (IR=150µA)



Transient Response (IR=5mA)

PRECISION 4.1 VOLT MICROPOWER VOLTAGE REFERENCE

ZR4040-4.1

ISSUE 1 - JULY 1995

DEVICE DESCRIPTION

The ZR4040-4.1 uses a bandgap circuit design to achieve a precision micropower voltage reference of 4.1 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZR4040-4.1 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZR4040-4.1 is recommended for operation between 60µA and 15mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

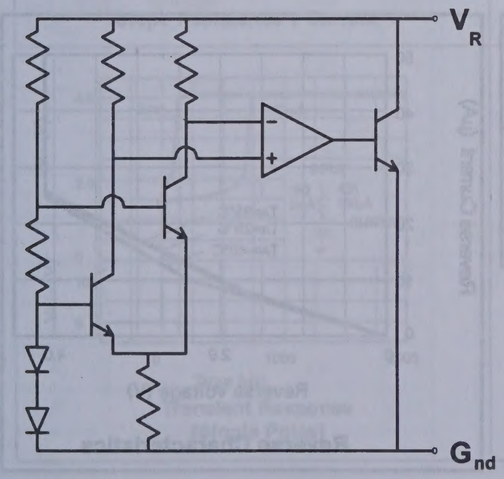
FEATURES

- Small outline SO8 and SOT23 packages
- TO92 style package
- No stabilising capacitor required
- Typical T_C 20ppm/°C
- Typical slope resistance 0.55Ω
- 2% and 1% tolerance
- Industrial temperature range
- Operating current 60µA to 15mA

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.
- Crystal oscillators.

SCHEMETIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin R
1	N/C	-	G_{nd}
2	N/C	G_{nd}	V_R
3	N/C	V_R	-
4	G_{nd}	–	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	V_R	–	–
Pack	N8	F	R

see Diagrams Page 1 - 8

ZR4040-4.1

ABSOLUTE MAXIMUM RATING

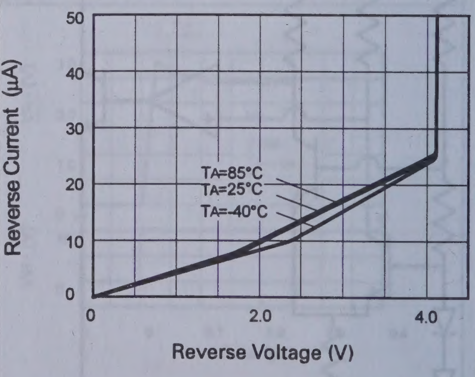
Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)	
SOT23	330mW
SO8	625mW
E-line, 3 pin (TO92)	500mW

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150µA	4.05 4.01	4.096 4.096	4.14 4.18	1 2	V
I_{MIN}	Minimum Operating Current			25	60		µA
I_R	Recommended Operating Current		0.06		15		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		20	100		ppm/°C
R_S §	Slope Resistance			0.55	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.5	1.2		Ω

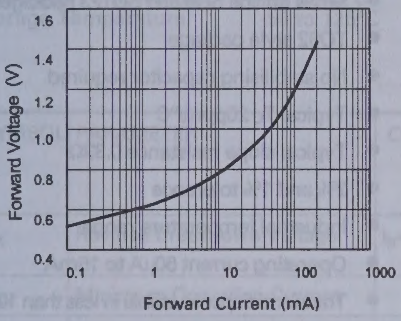
† $$T_C = \frac{V_R\ Change\ \times 1000000}{V_R \times Temperature\ \ Change}$$

§ $$R_S = \frac{V_R\ Change\ \ (I_R\ (min)\ to\ I_R\ (max))}{I_R\ (max) - I_R\ (min)}$$

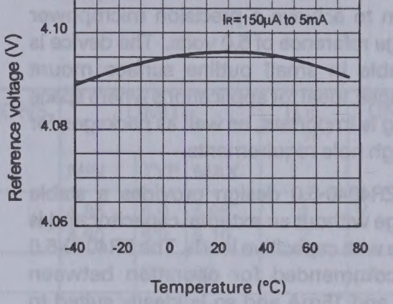


Reverse Characteristics

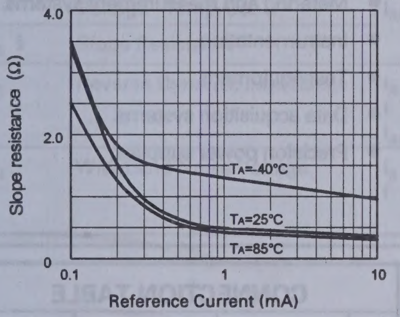
TYPICAL CHARACTERISTICS



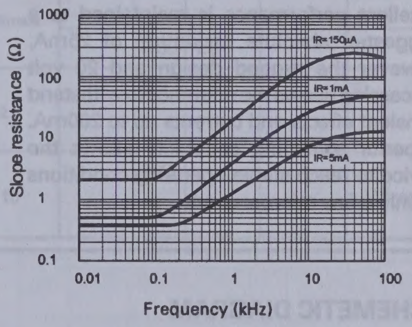
Forward Characteristics



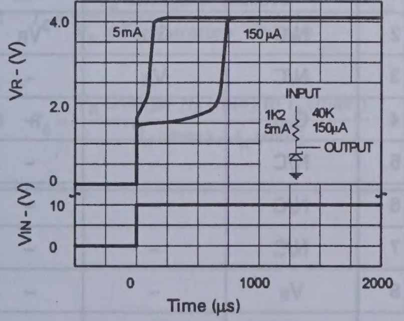
Temperature Drift



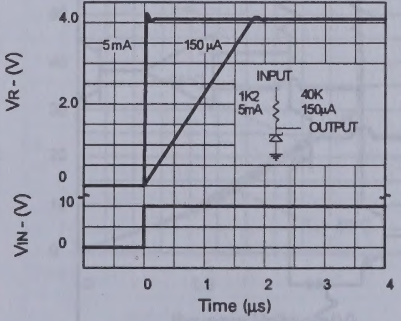
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response
(Single Pulse)



Transient Response
(Repetitive Pulse)

PRECISION 5.0 VOLT MICROPOWER VOLTAGE REFERENCE

ZR4040-5.0

ISSUE 1 - JULY 1995

DEVICE DESCRIPTION

The ZR4040-5.0 uses a bandgap circuit design to achieve a precision micropower voltage reference of 5.0 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZR4040-5.0 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZR4040-5.0 is recommended for operation between 60µA and 15mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

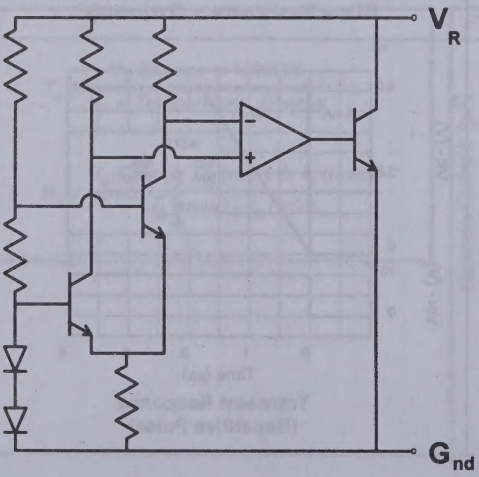
FEATURES

- Small outline SO8 and SOT23 packages
- TO92 style package
- No stabilising capacitor required
- Typical T_C 20ppm/°C
- Typical slope resistance 0.33Ω
- 2% and 1% tolerance
- Industrial temperature range
- Operating current 60µA to 15mA
- Transient response,stable in less than 10µs

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.

SCHEMETIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin R
1	N/C	-	G_{nd}
2	N/C	G_{nd}	V_R
3	N/C	V_R	-
4	G_{nd}	–	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	V_R	–	–
Pack	N8	F	R

see Diagrams Page 1 - 8

ZR4040-5.0

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

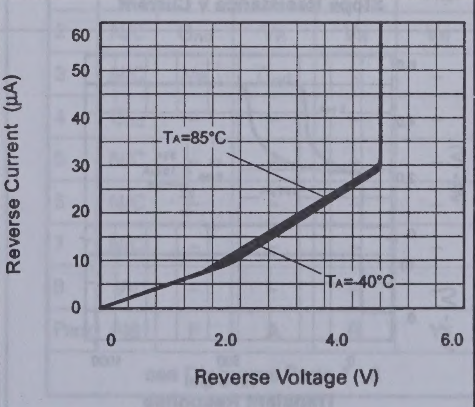
Power Dissipation (T_{amb}=25°C)

SOT23	330mW
SO8	625mW
E-line, 3 pin (TO92)	500mW

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150μA	4.95 4.90	5.0 5.0	5.05 5.10	1 2	V
I_{MIN}	Minimum Operating Current			30	60		μA
I_R	Recommended Operating Current		0.06		15		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		20	100		ppm/°C
R_S §	Slope Resistance			0.33	1.5		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.4	1.0		Ω
E_N	Wideband Noise Voltage	I_R = 1mA f = 10Hz to 10kHZ		100			μV (rms)

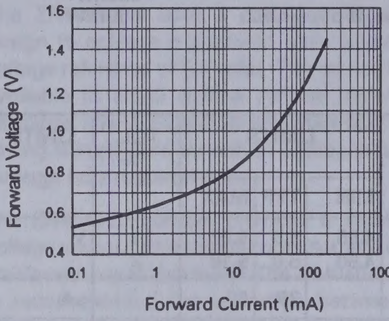
$$\dagger \quad T_C = \frac{V_R\ Change\ \ x\ 1000000}{V_R\ x\ Temperature\ \ Change}$$

$$\S \quad R_S = \frac{V_R\ Change\ \ (I_R\ (min)\ to\ I_R\ (max))}{I_R\ (max) - I_R\ (min)}$$

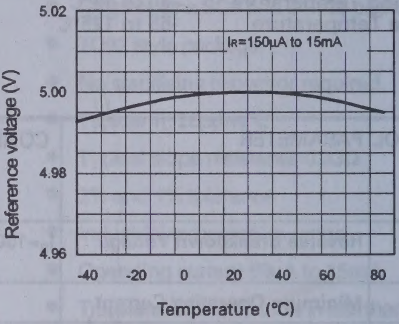


Reverse Characteristics

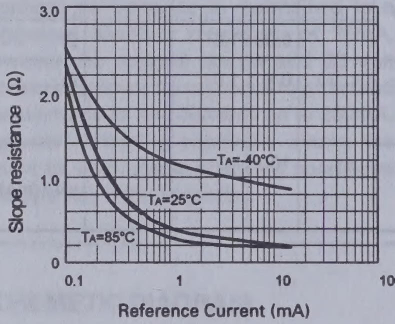
TYPICAL CHARACTERISTICS



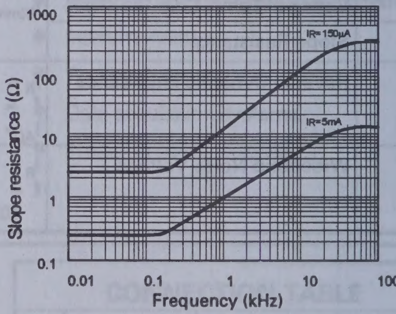
Forward Characteristics



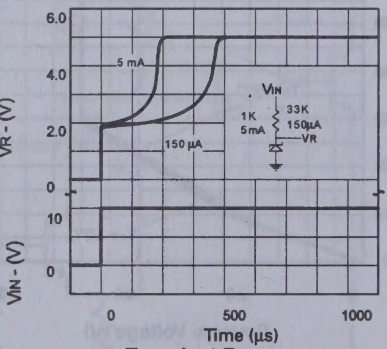
Temperature Drift



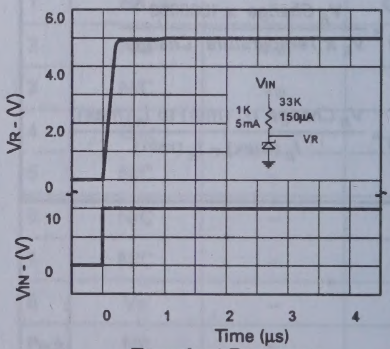
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response (Single Pulse)



Transient Response (Repetitive Pulse)

PRECISION 1.25 VOLT MICROPOWER VOLTAGE REFERENCE

ZRA124

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRA124 uses a bandgap circuit design to achieve a precision micropower voltage reference of 1.24 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZRA124 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRA124 is recommended for operation between 50µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

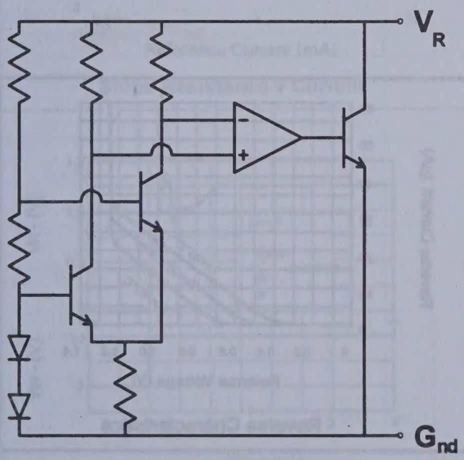
FEATURES

- Small outline SOT23, SO8 and TO92 style packages
- No stabilising capacitor required
- Typical T_C 30ppm/°C
- Typical slope resistance 0.65Ω
- ± 1% tolerance
- Industrial temperature range
- Operating current 50µA to 5mA
- Transient response, stable in less than 10µs

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Precision power supplies.
- Test equipment.
- Data acquisition systems

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y

see Diagrams Page 1 - 8

ZRA124

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

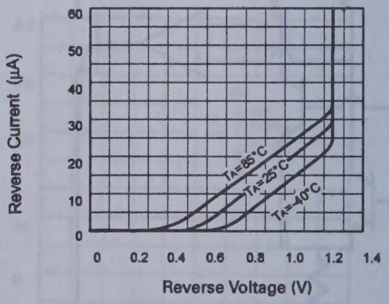
SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150μA	1.228	1.24	1.252	1	V
I_{MIN}	Minimum Operating Current			30	50		μA
I_R	Recommended Operating Current		0.05		5		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		30	90		ppm/°C
R_S §	Slope Resistance			0.65	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.5	1		Ω
E_N	Wideband Noise Voltage	I_R = 150μA f = 100Hz to 10kHZ		70			μV(rms)

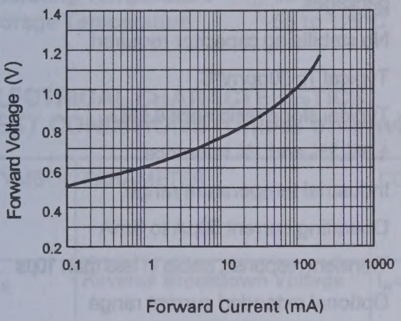
† $$T_C = \frac{V_R\ Change\ \times 1000000}{V_R \times Temperature\ \ Change}$$

§ $$R_S = \frac{V_R\ Change\ \ (I_R\,(min)\ to\ I_R\,(max))}{I_R\,(max) - I_R\,(min)}$$

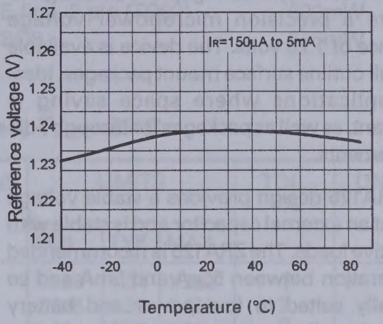


Reverse Characteristics

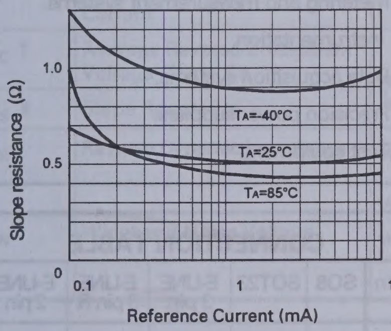
TYPICAL CHARACTERISTICS



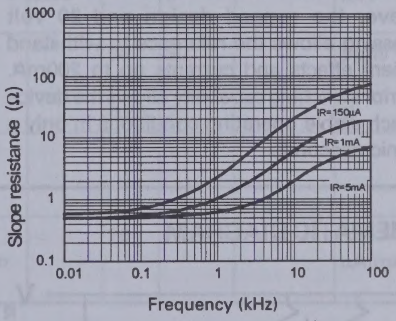
Forward Characteristics



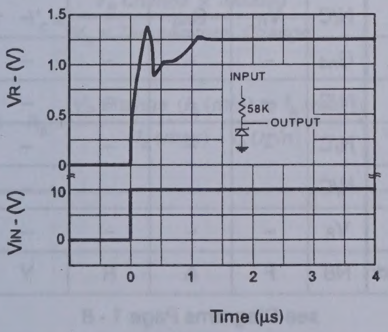
Temperature Drift



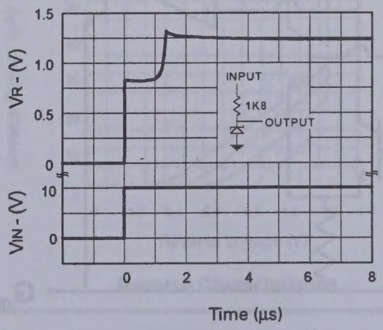
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response (IR=150µA)



Transient Response (IR=5mA)

PRECISION 1.25 VOLT MICROPOWER VOLTAGE REFERENCE

ZRA125

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRA125 uses a bandgap circuit design to achieve a precision micropower voltage reference of 1.25 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZRA125 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRA125 is recommended for operation between 50µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

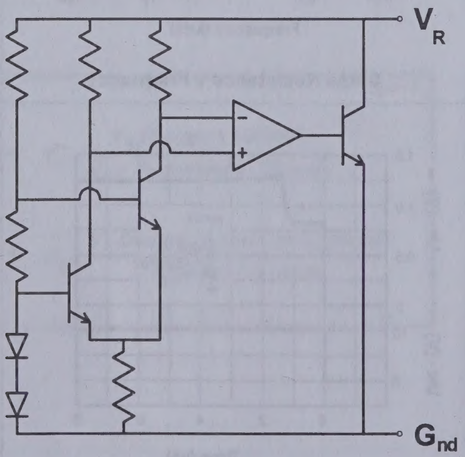
FEATURES

- Small outline SOT23, SO8 and TO92 style packages
- No stabilising capacitor required
- Typical T_C 30ppm/°C
- Typical slope resistance 0.65Ω
- ± 3%,2% and 1% tolerance
- Industrial temperature range
- Operating current 50µA to 5mA
- Transient response, stable in less than 10µs
- Optional extended current range

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Data acquisition systems.
- Precision power supplies.
- Test equipment.

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y

see Diagrams Page 1 - 8

ZRA125

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

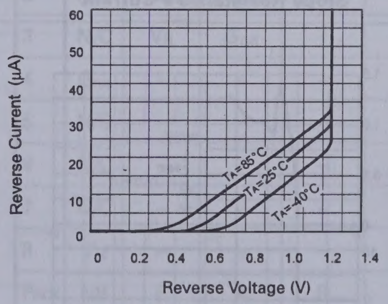
SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150μA	1.228 1.225 1.21	1.24 1.25 1.25	1.252 1.275 1.29	1 2 3	V
I_{MIN}	Minimum Operating Current			30	50		μA
I_R	Recommended Operating Current		0.05		5		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		30	90		ppm/°C
R_S §	Slope Resistance			0.65	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.5	1		Ω
E_N	Wideband Noise Voltage	I_R = 150μA f = 100Hz to 10kHZ		70			μA(max)

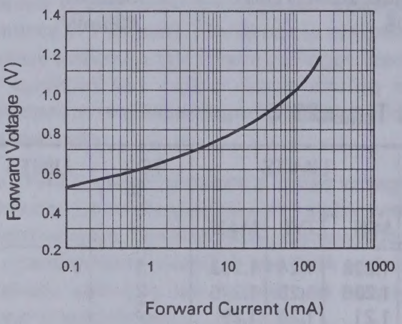
† $$T_C = \frac{V_R\ Change\ \times 1000000}{V_R \times Temperature\ \ Change}$$

§ $$R_S = \frac{V_R\ Change\ \ (I_R\,(min)\ to\ I_R\,(max))}{I_R\,(max) - I_R\,(min)}$$

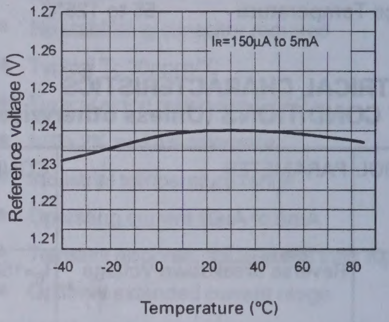


Reverse Characteristics

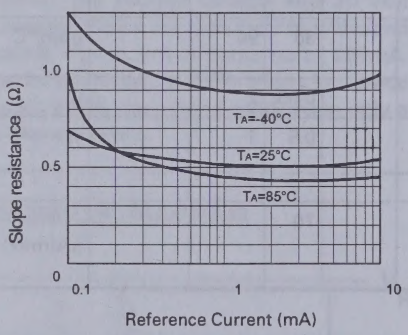
TYPICAL CHARACTERISTICS



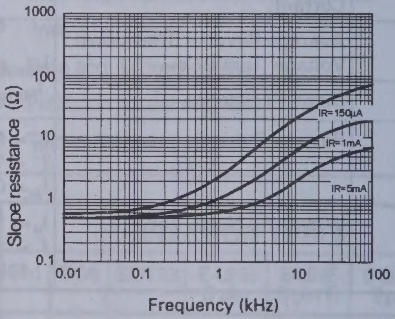
Forward Characteristics



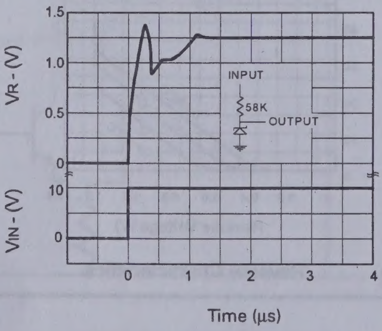
Temperature Drift



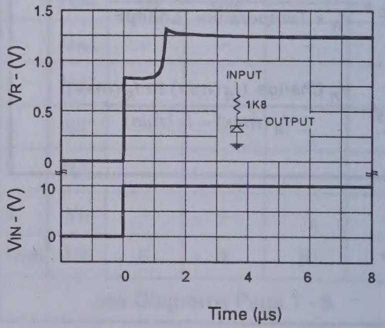
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response (IR=150µA)



Transient Response (IR=5mA)

PRECISION 2.45 VOLT VOLTAGE REFERENCE

ZRA245

ISSUE 2 — OCTOBER 94

DEVICE DESCRIPTION

The ZRA245 uses a bandgap circuit design to achieve a precision voltage reference of 2.45 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important.

The ZRA245 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRA245 is recommended for operation between 2mA and 120mA.

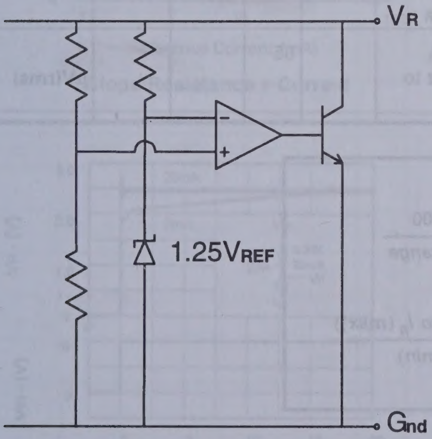
FEATURES

- Small outline SOT23, SO8 and TO92 style package
- No stabilising capacitor required
- Typical T_C 15ppm/°C
- Typical slope resistance 0.26Ω
- ± 3% , 2% and 1% tolerance
- Industrial temperature range
- Operating current 2mA to 120mA

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	–	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y

- see Diagrams Page 1 - 8

ZRA245

ABSOLUTE MAXIMUM RATING

Reverse Current	200mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

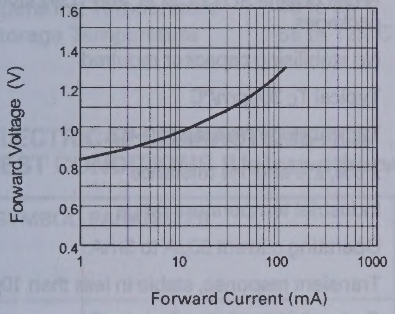
ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=5mA	2.43 2.40 2.38	2.45 2.45 2.45	2.47 2.50 2.52	1 2 3	V
I_{MIN}	Minimum Operating Current				2		mA
I_R	Recommended Operating Current		2		120		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		15	50		ppm/°C
R_S §	Slope Resistance			0.26	0.5		Ω
Z_R	Reverse Dynamic Impedance	I_R = 5mA f = 100Hz I_{AC}= 0.1 I_R		0.28	1		Ω
E_N	Wideband Noise Voltage	I_R= 5mA f = 10Hz to 10kHZ		65			µV(rms)

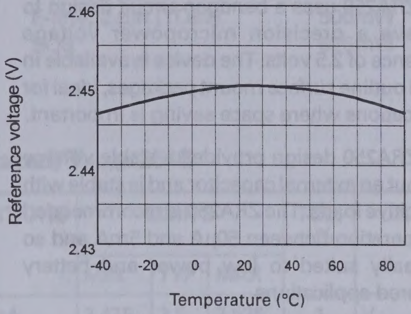
† $$T_C = \frac{V_R\ Change\ \ x\ 1000000}{V_R\ x\ Temperature\ \ Change}$$

§ $$R_S = \frac{V_R\ Change\ \ (I_R\,(min)\ to\ I_R\,(max))}{I_R\,(max) - I_R\,(min)}$$

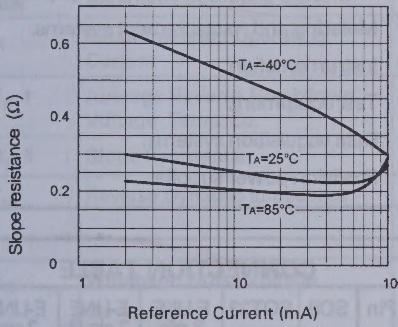
TYPICAL CHARACTERISTICS



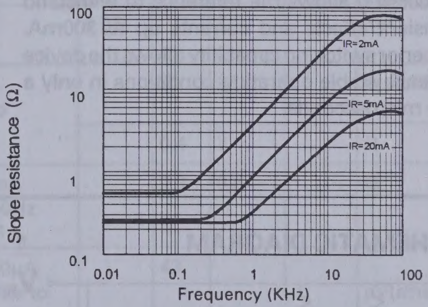
Forward Characteristics



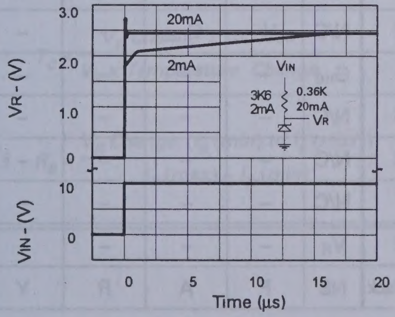
Temperature Drift



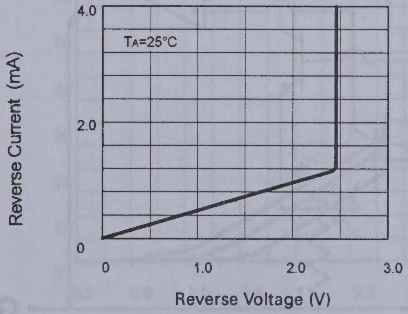
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response



Reverse Characteristics

PRECISION 2.5 VOLT MICROPOWER VOLTAGE REFERENCE

ZRA250

ISSUE 1 - JANUARY 1996

DEVICE DESCRIPTION

The ZRA250 uses a bandgap circuit design to achieve a precision micropower voltage reference of 2.5 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important.

The ZRA250 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRA250 is recommended for operation between 50µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

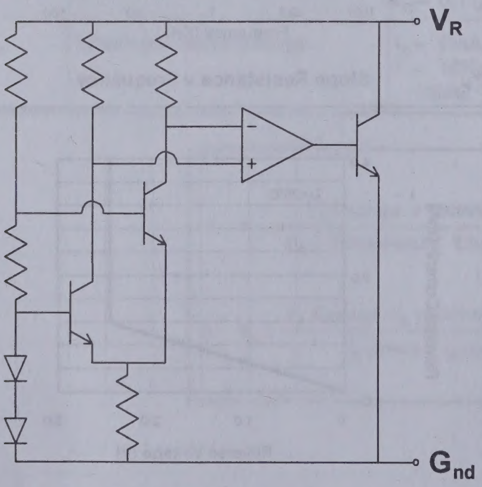
FEATURES

- Small outline SOT23, SO8 and TO92 style packages.
- No stabilising capacitor required
- Typical T_C 30ppm/°C
- Typical slope resistance 0.4Ω
- ± 3%, 2% and 1% tolerance
- Industrial temperature range
- Operating current 50µA to 5mA
- Transient response, stable in less than 10µs
- Optional extended current range

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y

see Diagrams Page 1 - 8

ZRA250

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

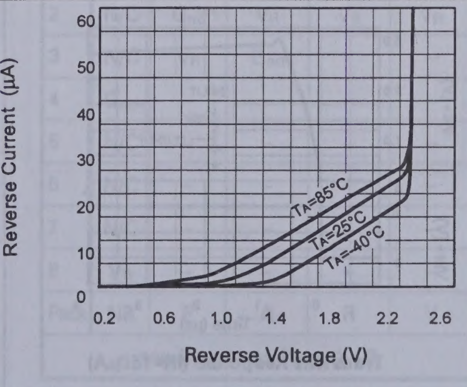
SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150μA	2.475 2.45 2.425	2.5 2.5 2.5	2.525 2.55 2.575	1 2 3	V
I_{MIN}	Minimum Operating Current			25	50		μA
I_R	Recommended Operating Current		0.05		5		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		30	90		ppm/°C
R_S §	Slope Resistance			0.4	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.3	0.8		Ω
E_N	Wideband Noise Voltage	I_R = 150μA f = 10Hz to 10kHZ		43			μV(rms)

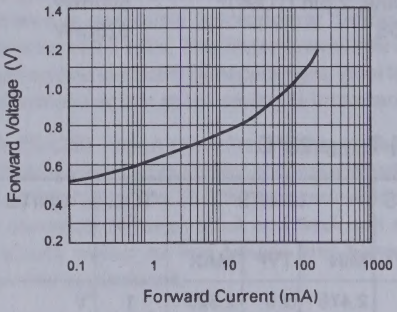
† $$T_C = \frac{V_R\ Change\ \times 1000000}{V_R \times Temperature\ \ Change}$$

§ $$R_S = \frac{V_R\ Change\ \ (I_R\,(min)\ to\ I_R\,(max))}{I_R\,(max) - I_R\,(min)}$$

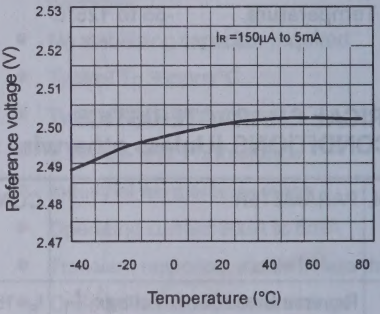


Reverse Characteristics

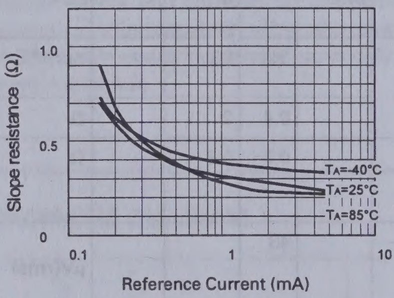
TYPICAL CHARACTERISTICS



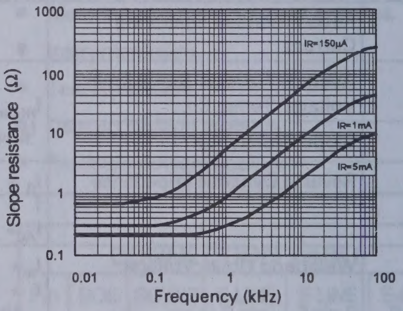
Forward Characteristics



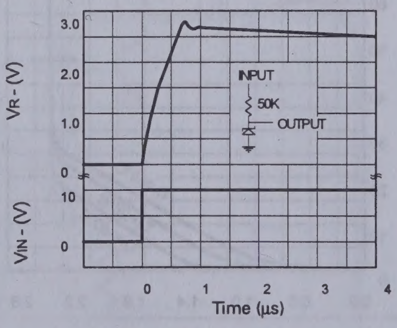
Temperature Drift



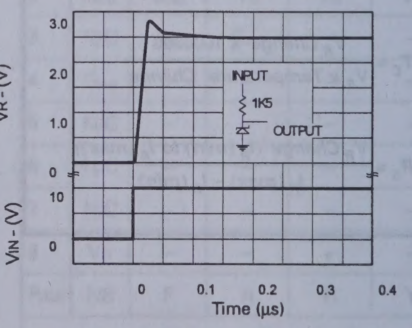
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response (IR=150µA)



Transient Response (IR=5mA)

PRECISION 4.0 VOLT MICROPOWER VOLTAGE REFERENCE

ZRA400

ISSUE 1 - JANUARY 1996

DEVICE DESCRIPTION

The ZRA400 uses a bandgap circuit design to achieve a precision micropower voltage reference of 4.096 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important.

The ZRA400 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRA400 is recommended for operation between 50µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

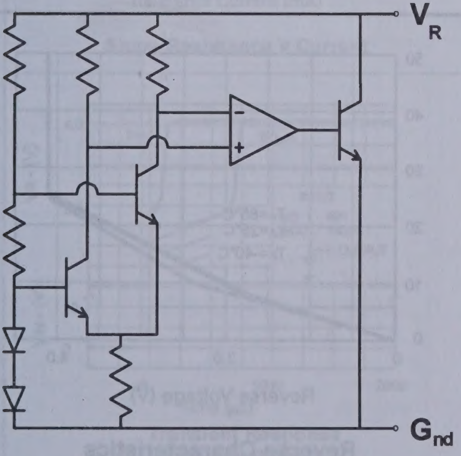
FEATURES

- Small outline SO8, SOT23 and TO92 style packages.
- No stabilising capacitor required
- Typical T_C 15ppm/°C
- Typical slope resistance 0.55Ω
- ± 3%, 2% and 1% tolerance
- Industrial temperature range
- Operating current 50µA to 5mA

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.
- Crystal oscillators

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y

see Diagrams Page 1 - 8

ZRA400

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

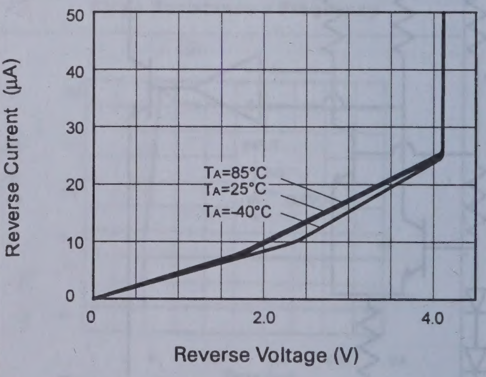
SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150µA	4.05 4.01 3.97	4.096 4.096 4.096	4.14 4.18 4.22	1 2 3	V
I_{MIN}	Minimum Operating Current			25	50		µA
I_R	Recommended Operating Current		0.05		5		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		15	50		ppm/°C
R_S §	Slope Resistance			0.55	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.5	1.2		Ω

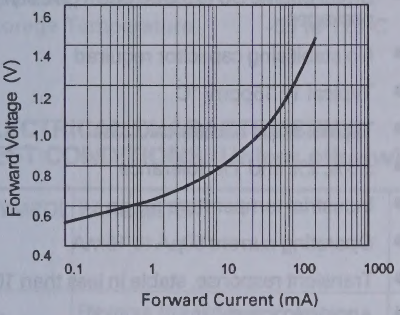
† $$T_C = \frac{V_R\ Change\ \times 1000000}{V_R \times Temperature\ \ Change}$$

§ $$R_S = \frac{V_R\ Change\ \ (I_R\,(min)\ to\ I_R\,(max))}{I_R\,(max) - I_R\,(min)}$$

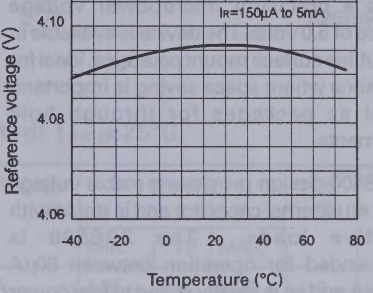


Reverse Characteristics

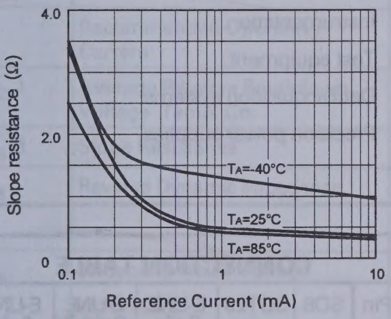
TYPICAL CHARACTERISTICS



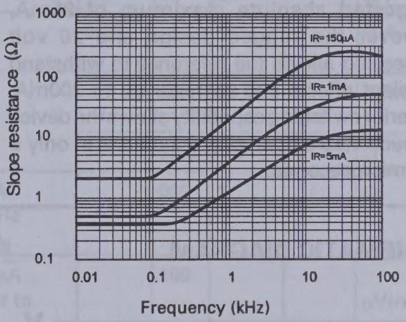
Forward Characteristics



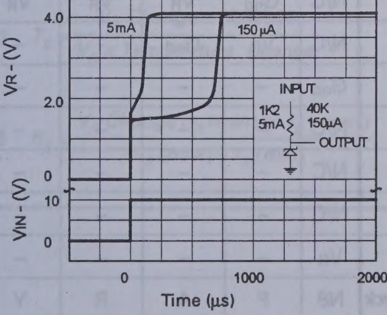
Temperature Drift



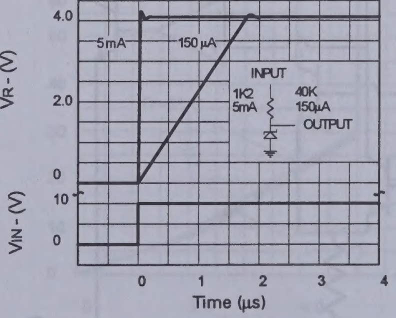
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response (Single Pulse)



Transient Response (Repetitive Pulse)

PRECISION 5.0 VOLT MICROPOWER VOLTAGE REFERENCE

ZRB500

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRB500 uses a bandgap circuit design to achieve a precision micropower voltage reference of 5.0 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

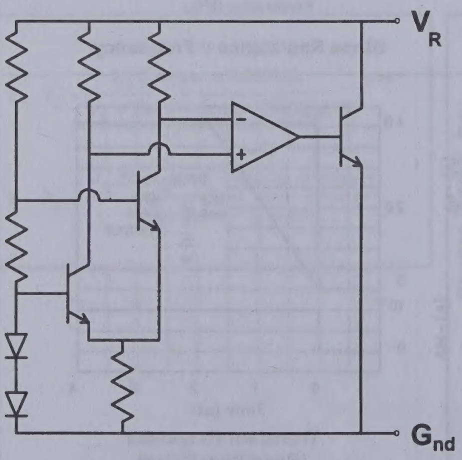
The ZRB500 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRB500 is recommended for operation between 50µA and 15mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

FEATURES

- Small outline SOT23,SO8 and TO92 style packages
- No stabilising capacitor required
- Typical T_C 15ppm/ °C
- Typical slope resistance 0.33Ω
- ± 3%, 2% and 1% tolerance
- Industrial temperature range
- Operating current 50µA to 15mA
- Transient response, stable in less than 10µs
- **APPLICATIONS**
- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.

SCHEMATIC DIAGRAM



CONNECTION TABLE					
Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y
see Diagrams Page 1 - 8					

ZRB500

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

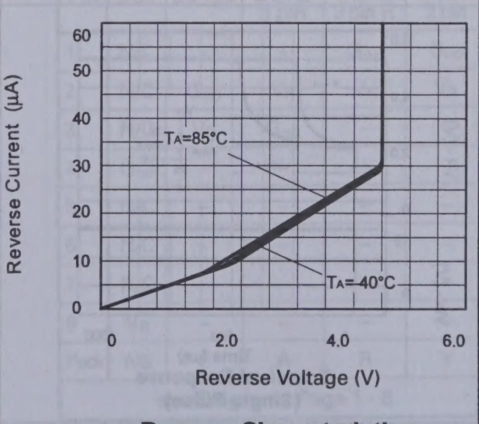
SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150µA	4.95 4.90 4.85	5.0 5.0 5.0	5.05 5.10 5.15	1 2 3	V
I_{MIN}	Minimum Operating Current			30	50		µA
I_R	Recommended Operating Current		0.05		15		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		15	50		ppm/°C
R_S §	Slope Resistance			0.33	1.5		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.4	1		Ω
E_N	Wideband Noise Voltage	I_R = 150µA f = 10Hz to 10kHZ		100			µV(rms)

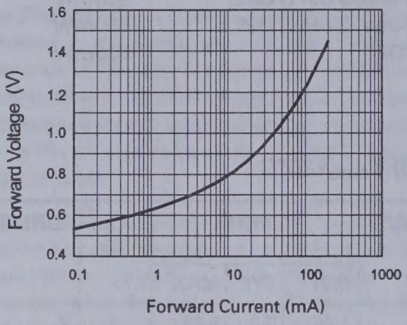
$$\dagger \quad T_C = \frac{V_R \; Change \times 1000000}{V_R \times Temperature \;\; Change}$$

$$\S \quad R_S = \frac{V_R \; Change \; (I_R \, (min) \; to \; I_R \, (max))}{I_R \, (max) - I_R \, (min)}$$

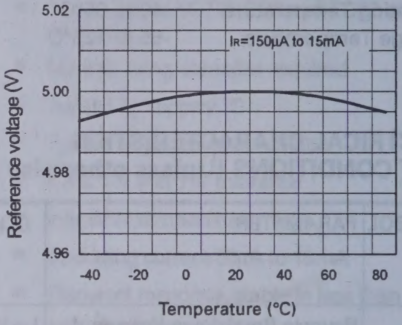


Reverse Characteristics

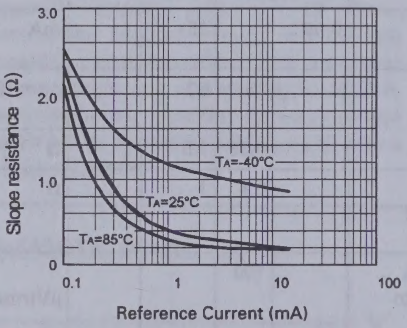
TYPICAL CHARACTERISTICS



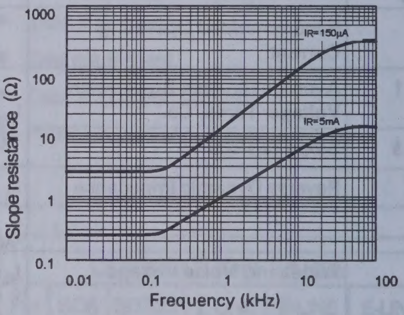
Forward Characteristics



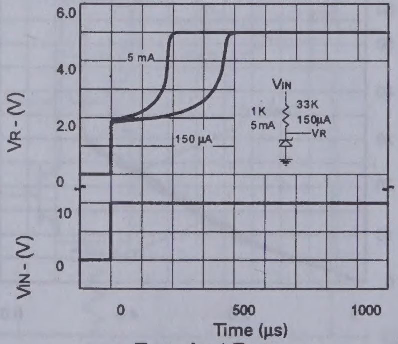
Temperature Drift



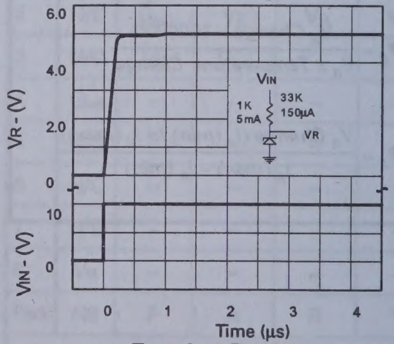
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response
(Single Pulse)



Transient Response
(Repetitive Pulse)

PRECISION 2.5 VOLT MICROPOWER VOLTAGE REFERENCE

ZRC250

ISSUE 1- OCTOBER 1995

DEVICE DESCRIPTION

The ZRC250 uses a bandgap circuit design to achieve a precision micropower voltage reference of 2.5 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZRC250 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRC250 is recommended for operation between 20µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

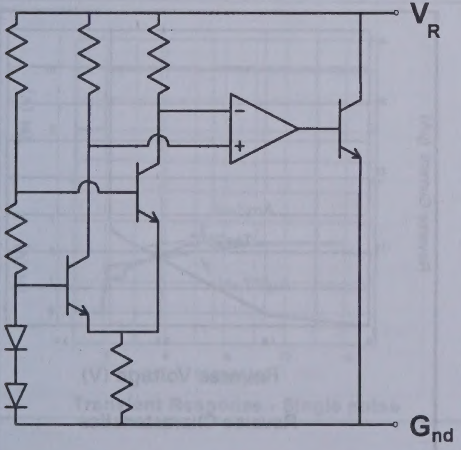
FEATURES

- Small outline SOT23 and SO8 packages
- TO92 style packages
- No stabilising capacitor required
- Low knee current, 15µA typical
- Typical T_C 30ppm/°C
- Typical slope resistance 0.4Ω
- ± 3% and 2% tolerance
- Industrial temperature range
- Operating current 20µA to 5mA
- Transient response, stable in less than 10µs
- Optional extended current range

APPLICATIONS

- Battery powered and portable equipment.
- Instrumentation.
- Test equipment.
- Metering and measurement systems.

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y

see Diagrams Page 1 - 8

ZRC250

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

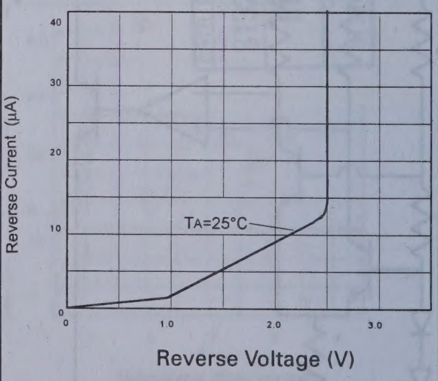
SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150µA	2.45 2.425	2.5 2.5	2.55 2.575	2 3	V
I_{MIN}	Minimum Operating Current			13	20		µA
I_R	Recommended Operating Current		0.02		5		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		30	90		ppm/°C
R_S §	Slope Resistance			0.4	1		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.3	0.8		Ω
E_N	Wideband Noise Voltage	I_R = 150µA f = 10Hz to 10kHZ		43			µV(rms)

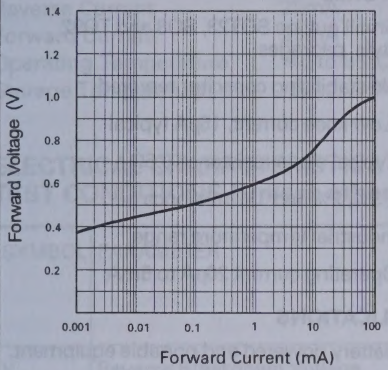
$$\dagger \quad T_C = \frac{V_R \; Change \; x \; 1000000}{V_R \; x \; Temperature \;\; Change}$$

$$\S \quad R_S = \frac{V_R \; Change \; (I_R\,(min) \; to \; I_R\,(max))}{I_R\,(max) - I_R\,(min)}$$

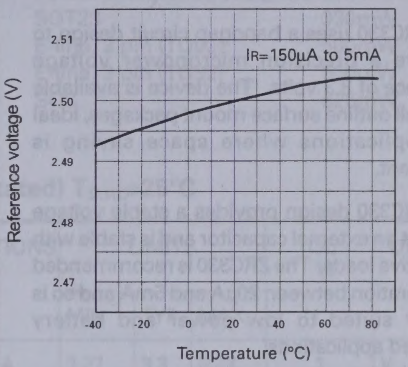


Reverse Characteristics

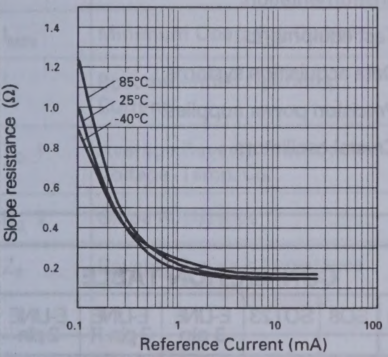
TYPICAL CHARACTERISTICS



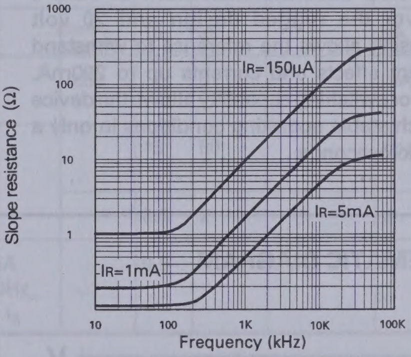
Forward Characteristics



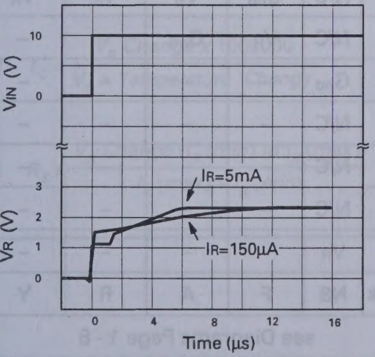
Temperature Drift



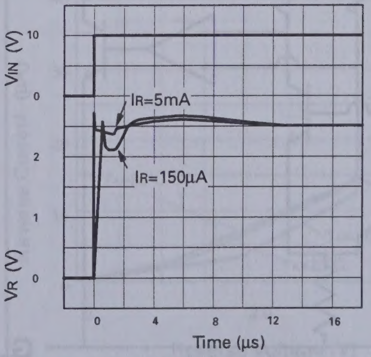
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response - Single pulse



Transient Response - Repetitive Test

PRECISION 3.3 VOLT LOW KNEE CURRENT VOLTAGE REFERENCE

ZRC330

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRC330 uses a bandgap circuit design to achieve a precision micropower voltage reference of 3.3 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important.

The ZRC330 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRC330 is recommended for operation between 20µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

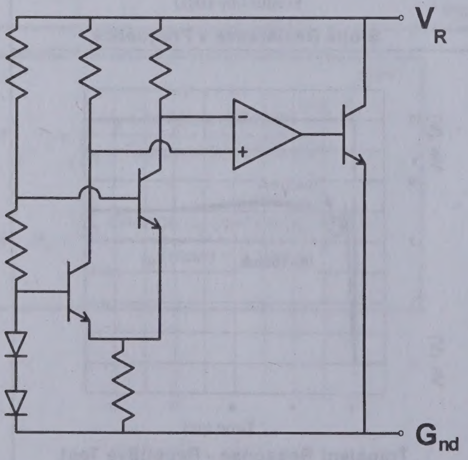
FEATURES

- Small outline SOT23, SO8 and TO92 style packages
- No stabilising capacitor required
- Low knee current, 15µA typical
- Typical slope resistance 0.6Ω
- ± 3%, 2% and 1% tolerance
- Industrial temperature range
- Operating current 20µA to 5mA

APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.
- Crystal oscillators

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y

see Diagrams Page 1 - 8

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

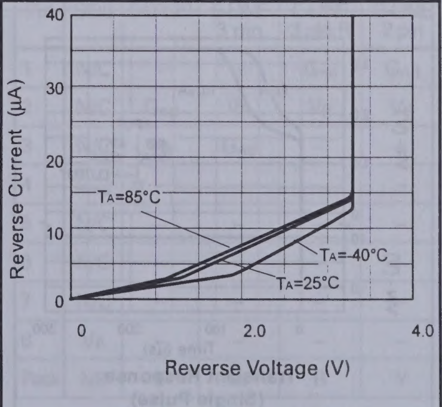
SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150μA	3.27 3.234 3.2	3.3 3.3 3.3	3.33 3.366 3.4	1 2 3	V
I_{MIN}	Minimum Operating Current			15	20		μA
I_R	Recommended Operating Current		0.02		5		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		15	50		ppm/°C
R_S §	Slope Resistance			0.6	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.5	1.2		Ω

$$\dagger \quad T_C = \frac{V_R\ Change \times 1000000}{V_R \times Temperature\ \ Change}$$

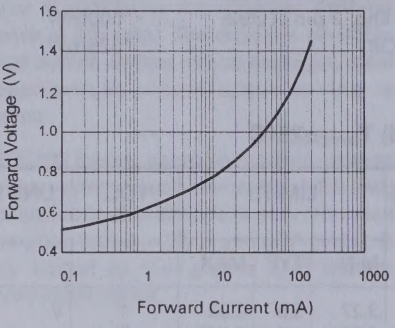
$$\S \quad R_S = \frac{V_R\ Change\ (I_R\ (min)\ to\ I_R\ (max))}{I_R\ (max) - I_R\ (min)}$$



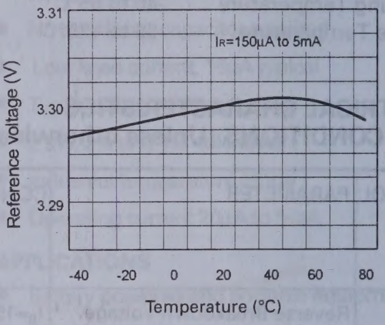
Reverse Characteristics

ZRC330

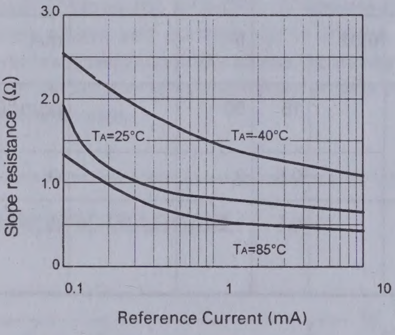
TYPICAL CHARACTERISTICS



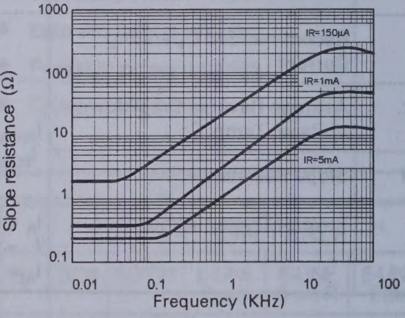
Forward Characteristics



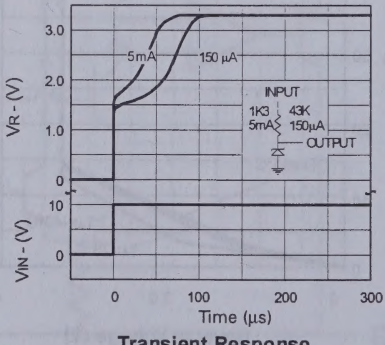
Temperature Drift



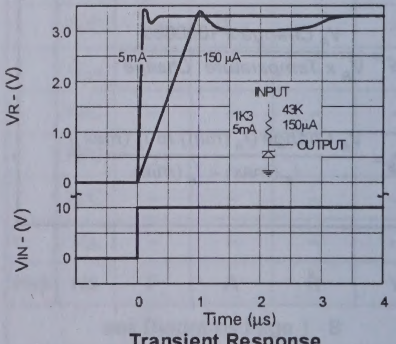
Slope Resistance v Current



Slope Resistance v Frequency



Transient Response (Single Pulse)



Transient Response (Repetitive Pulse)

PRECISION 4.1 VOLT MICROPOWER VOLTAGE REFERENCE

ZRC400

ADVANCED INFORMATION

DEVICE DESCRIPTION

The ZRC400 uses a bandgap circuit design to achieve a precision micropower voltage reference of 4.096 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZRC400 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRC400 is recommended for operation between 20µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

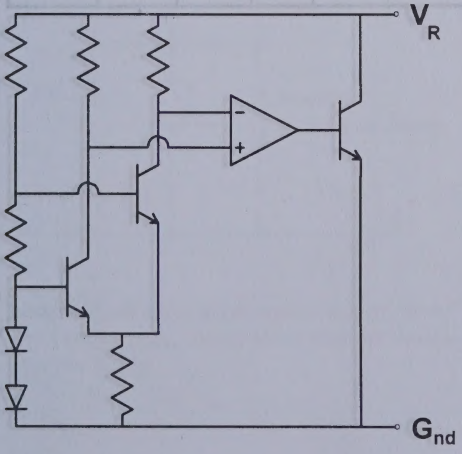
FEATURES

- Small outline SOT23 , SO8 and TO92 style packages
- No stabilising capacitor required
- Low knee current, 15µA typical
- Typical Tc 30ppm/°C
- Typical slope resistance 0.4Ω
- ± 3%, 2% and 1% tolerance
- Industrial temperature range
- Operating current 20µA to 5mA
- Transient response, stable in less than 10µs
- Optional extended current range

APPLICATIONS

- Battery powered and portable equipment.
- Instrumentation.
- Test equipment.
- Metering and measurement systems.

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y
see Diagrams Page 1 - 8					

ZRC400

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150μA	4.05	4.096	4.14	1	V
			4.01	4.096	4.18	2	
			3.97	4.096	4.22	3	
I_{MIN}	Minimum Operating Current			13	20		μA
I_R	Recommended Operating Current		0.02		5		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		30	90		ppm/°C
R_S §	Slope Resistance			0.4	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.3	0.8		Ω
E_N	Wideband Noise Voltage	I_R = 150μA f = 10Hz to 10kHZ		43			μV(rms)

$$† \quad T_C = \frac{V_R \; Change \times 1000000}{V_R \times Temperature \;\; Change}$$

$$§ \quad R_S = \frac{V_R \; Change \; (i_R \,(min) \; to \; I_R \,(max))}{I_R \,(max) - I_R \,(min)}$$

PRECISION 5.0 VOLT MICROPOWER VOLTAGE REFERENCE

ZRC500

ADVANCED INFORMATION

DEVICE DESCRIPTION

The ZRC500 uses a bandgap circuit design to achieve a precision micropower voltage reference of 5.0 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZRC500 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRC500 is recommended for operation between 20µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

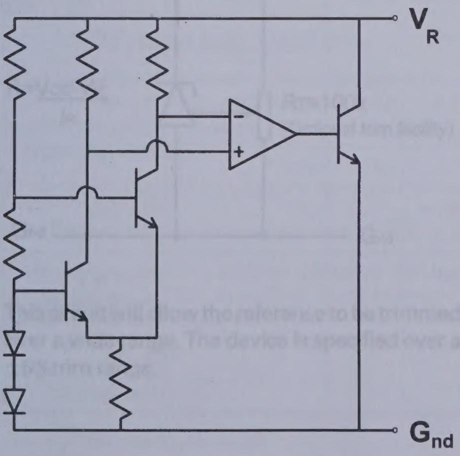
FEATURES

- Small outline SOT23, SO8 and TO92 style packages
- No stabilising capacitor required
- Low knee current, 15µA typical
- Typical T_C 30ppm/°C
- Typical slope resistance 0.4Ω
- ± 3%, 2% and 1% tolerance
- Industrial temperature range
- Operating current 20µA to 5mA
- Transient response, stable in less than 10µs
- Optional extended current range

APPLICATIONS

- Battery powered and portable equipment.
- Instrumentation.
- Test equipment.
- Metering and measurement systems.

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT23	E-LINE 3 pin	E-LINE 3 pin R	E-LINE 2 pin
1	N/C	-	-	G_{nd}	G_{nd}
2	N/C	G_{nd}	V_R	V_R	V_R
3	N/C	V_R	G_{nd}	-	–
4	G_{nd}	–	–	–	–
5	N/C	–	–	–	–
6	N/C	–	–	–	–
7	N/C	–	–	–	–
8	V_R	–	–	–	–
Pack	N8	F	A	R	Y
see Diagrams Page 1 - 8					

ZRC500

ABSOLUTE MAXIMUM RATING

Reverse Current	25mA
Forward Current	25mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

SOT23	330mW
E-line, 3 pin (TO92)	500mW
E-line, 2 pin (TO92)	500mW
SO8	625mW

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C

SYMBOL	PARAMETER	CONDITIONS	LIMITS			TOL. %	UNITS
			MIN	TYP	MAX		
V_R	Reverse Breakdown Voltage	I_R=150µA	4.95 4.9 4.85	5.0 5.0 5.0	5.05 5.1 5.15	1 2 3	V
I_{MIN}	Minimum Operating Current			13	20		µA
I_R	Recommended Operating Current		0.02		5		mA
T_C †	Average Reverse Breakdown Voltage Temp. Co.	$I_{R(min)}$ to $I_{R(max)}$		30	90		ppm/°C
R_S §	Slope Resistance			0.4	2		Ω
Z_R	Reverse Dynamic Impedance	I_R = 1mA f = 100Hz I_{AC}= 0.1 I_R		0.3	0.8		Ω
E_N	Wideband Noise Voltage	I_R = 150µA f = 10Hz to 10kHZ		43			µV(rms)

$$\dagger \quad T_C = \frac{V_R \; Change \; x \; 1000000}{V_R \; x \; Temperature \;\; Change}$$

$$\S \quad R_S = \frac{V_R \; Change \; (I_R\,(min) \; to \; I_R\,(max))}{I_R\,(max) - I_R\,(min)}$$

2.5V LOW POWER PRECISION REFERENCE SOURCE

ZRT025

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRT025 is a monolithic integrated circuit providing a precise stable reference voltage of 2.5V at 500µA.

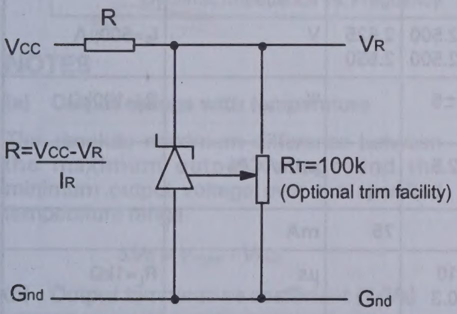
The circuit features a knee current of 150µA and operation over a wide range of temperatures and currents.

The ZRT025 is available in a 3-pin metal can package for through hole applications as well as SOT223 and SO8 packages for surface mount applications. Each package option offers a trim facility whereby the output voltage can be adjusted as shown in Fig.1. This facility is used when compensating for system errors or setting the reference output to a particular value. When the trim facility is not used, the pin should be left open circuit.

FEATURES

- Trimmable output
- Excellent temperature stability
- Low output noise figure
- Available in two temperature ranges
- 1 and 2% initial voltage tolerance versions available
- No external stabilising capacitor required in most cases
- Low slope resistance
- No derating required at low temperatures
- TO18 package
- SOT223 and SO8 small outline packages

SCHEMATIC DIAGRAM



$R = \frac{V_{CC} - V_R}{I_R}$

This circuit will allow the reference to be trimmed over a wide range. The device is specified over a ±5%trim range.

CONNECTION TABLE

Pin	SO8	SOT223	TO18
1	Trim	Trim	V_R
2	N/C	Gnd	Trim
3	N/C	V_R	Gnd
4	Gnd	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	V_R	–	–
Pack	N8	G	–

see Diagrams Page 1 - 8

ZRT025

ABSOLUTE MAXIMUM RATING

Reverse Current	75mA ø
Operating Temperature	
A grade	-55°C to 125°C
C grade	0°C to 70°C
Storage Temperature	
TO18	-55 °C to 175 °C
SO8, SOT223	-55 °C to 125 °C

Power Dissipation (T_{amb}=25°C)

TO18	300mW
SO8	625mW
SOT223	2W

ø Above 72°C this figure should be linearly derated to 25mA at 125°C

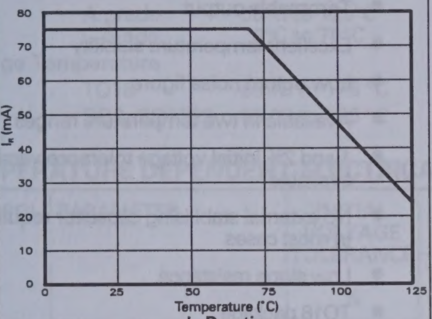
TEMPERATURE DEPENDENT ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	INITIAL VOLTAGE TOLERANCE %	GRADE A -55°C TO 125°C		GRADE C 0°C TO 70°C		UNITS
			TYP	MAX	TYP	MAX	
ΔV_R	Output voltage change over relevant temperature range (See note (a))	1 & 2	6.8	22.5	2.7	8.8	mV
T_CV_R	Output voltage temperature coefficient (See note (b))	1 & 2	15.0	50.0	15.0	50.0	ppm/°C

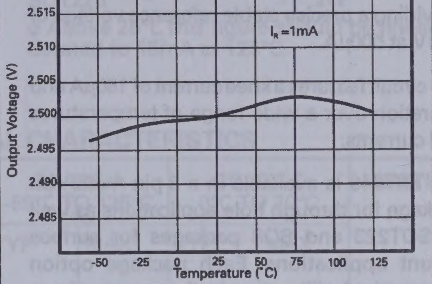
ELECTRICAL CHARACTERISTICS
(at T_{amb}=25°C and Pin 2 o/c unless otherwise stated)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	Comments
V_R	Output voltage 1% tolerance (A1,C1) 2% tolerance (C2)	 2.475 2.450	 2.500 2.500	 2.525 2.550	V	I_R=500µA
ΔV_{TRIM}	Output voltage adjustment range		±5		%	R_T=100kΩ
$T_C\Delta V_{TRIM}$	Change in T_CV_R with output adjustment		2.5		ppm/°C/%	
I_R	Operating current range	0.15		75	mA	
t_{on} t_{off}	Turn-on time Turn-off time		10 0.3		µs	R_L=1kΩ
e_{np-p}	Output voltage noise (over the range 0.1 to 10Hz)		50		µV	Peak to peak measurement
R_S	Slope resistance		0.85	2.0	Ω	I_R 0.5mA to 5mA See note (c)

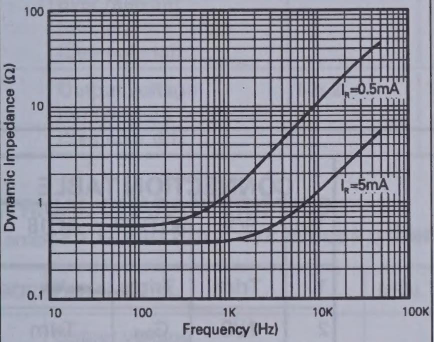
TYPICAL CHARACTERISTICS



I_R Derating



Temperature Drift



Dynamic Impedance vs. Frequency

NOTES

(a) Output change with temperature

The absolute maximum difference between the maximum output voltage and the minimum output voltage over the specified temperature range

$$\Delta V_R = V_{max} - V_{min}$$

(b) Output temperature coefficient (T_CV_R)

The ratio of the output change with temperature to the specified temperature range expressed in ppm/°C

$$T_cV_R = \frac{\Delta V_R \times 10^6}{V_R \times \Delta T} \text{ ppm/°C}$$

ΔT= Full temperature range

(c) Slope resistance (R_S)

The slope resistance is defined as :

$$R_S = \frac{\text{change in } V_R}{\text{specified current range}}$$

$\Delta I = 5 - 0.5 = 4.5mA$ (typically)

(d) Line regulation

The ratio of change in output voltage to the change in input voltage producing it.

$$\frac{R_S \times 100}{V_R \times R_{source}} \ \%/V$$

4.0V LOW POWER PRECISION REFERENCE SOURCE

ZRT040

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRT040 is a monolithic integrated circuit providing a precise stable reference voltage of 4.01V at 500μA.

The circuit features a knee current of 150μA and operation over a wide range of temperatures and currents.

The ZRT040 is available in a 3-pin metal can package for through hole applications as well as SOT223 and SO8 packages for surface mount applications. Each package option offers a trim facility whereby the output voltage can be adjusted as shown in Fig.1. This facility is used when compensating for system errors or setting the reference output to a particular value. When the trim facility is not used, the pin should be left open circuit.

FEATURES

- Trimmable output
- Excellent temperature stability
- Low output noise figure
- Available in two temperature ranges
- 1 and 2% initial voltage tolerance versions available
- No external stabilising capacitor required in most cases
- Low slope resistance
- TO18 package
- SOT223 and SO8 small outline packages

SCHEMATIC DIAGRAM

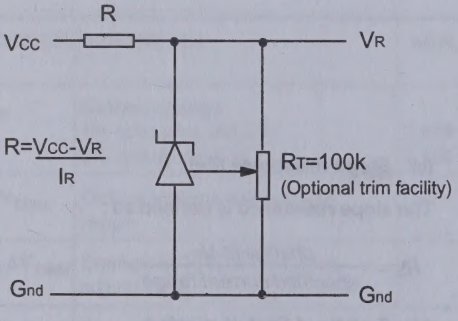


Figure 1:
This circuit will allow the reference to be trimmed over a wide range. The device is specified over a ±5% trim range.

CONNECTION TABLE

Pin	SO8	SOT223	TO18
1	Trim	Trim	V_R
2	N/C	G_{nd}	Trim
3	N/C	V_R	G_{nd}
4	G_{nd}	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	V_R	–	–
Pack	N8	G	–

see Diagrams Page 1 - 8

ABSOLUTE MAXIMUM RATING

Reverse Current	75mA ø
Operating Temperature	
A grade	-55°C to 125°C
C grade	0°C to 70°C
Storage Temperature	
TO18	-55 °C to 175 °C
SO8, SOT223	-55 °C to 125 °C

Power Dissipation (T_{amb}=25°C)

TO18	300mW
SO8	625mW
SOT223	2W

ø Above 25°C this figure should be linearly derated to 15mA at 125°C

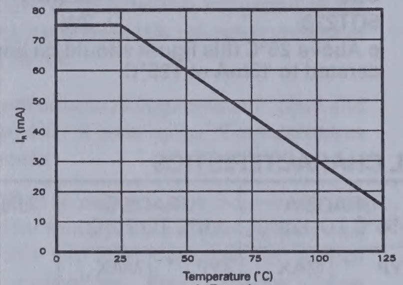
TEMPERATURE DEPENDENT ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	INITIAL VOLTAGE TOLERANCE %	GRADE A -55°C TO 125°C		GRADE C 0°C TO 70°C		UNITS
			TYP	MAX	TYP	MAX	
ΔV_R	Output voltage change over relevant temperature range (See note (a))	1 & 2	11.0	36.0	4.2	14.0	mV
$T_C V_R$	Output voltage temperature coefficient (See note (b))	1 & 2	15.0	50.0	15.0	50.0	ppm/°C

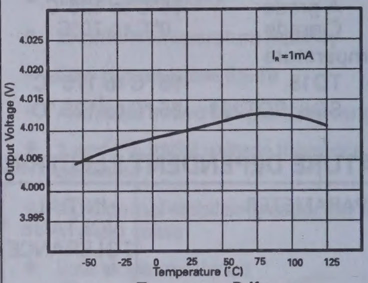
ELECTRICAL CHARACTERISTICS
(at T_{amb}=25°C and Pin 2 o/c unless otherwise stated)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	COMMENTS
V_R	Output voltage 1% tolerance (A1,C1) 2% tolerance (C2)	 3.97 3.93	 4.01 4.01	 4.05 4.09	 V	 I_R=500µA
ΔV_{TRIM}	Output voltage adjustment range		±5		%	R_T=100kΩ
$T_C \Delta V_{TRIM}$	Change in $T_C V_R$ with output adjustment		2.5		ppm/°C/%	
I_R	Operating current range	0.15		75	mA	
t_{on} t_{off}	Turn-on time Turn-off time		40 0.3		µs	R_L=1kΩ
$e_{np\text{-}p}$	Output voltage noise (over the range 0.1 to 10Hz)		50		µV	Peak to peak measurement
R_S	Slope resistance		1.1	3.0	Ω	I_R 0.5mA to 5mA See note (c)

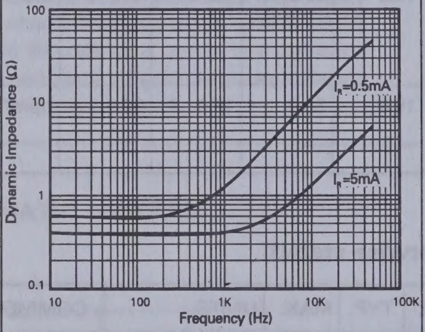
TYPICAL CHARACTERISTICS



I_R Derating



Temperature Drift



Dynamic Impedance vs. Frequency

NOTES

(a) Output change with temperature. (V_R)

The absolute maximum difference between the maximum output voltage and the minimum output voltage over the specified temperature range

$$\Delta V_R = V_{max} - V_{min}$$

(b) Output temperature coefficient (T_CV_R)

The ratio of the output change with temperature to the specified temperature range expressed in ppm/°C

$$T_cV_R = \frac{\Delta V_R \times 10^6}{V_R \times \Delta T}\ ppm/°C$$

ΔT= Full temperature range

(c) Operating current (I_R)

Maximum operating current must be derated as indicated in maximum ratings.

(d) Slope resistance (R_S)

The slope resistance is defined as :

$$R_S = \frac{\text{change in } V_R}{\text{specified current range}}$$

$\Delta I = 5 - 0.5 = 4.5mA$ *(typically)*

(e) Line regulation

The ratio of change in output voltage to the change in input voltage producing it.

$$\frac{R_S \times 100}{V_R \times R_{source}}\ \%/V$$

5.0V LOW POWER PRECISION REFERENCE SOURCE

ZRT050

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRT050 is a monolithic integrated circuit providing a precise stable reference voltage of 4.9V at 500µA.

The circuit features a knee current of 150µA and operation over a wide range of temperatures and currents.

The ZRT050 is available in a 3-pin metal can package for through hole applications as well as SOT223 and SO8 packages for surface mount applications. Each package option offers a trim facility whereby the output voltage can be adjusted as shown in Fig.1. This facility is used when compensating for system errors or setting the reference output to a particular value. When the trim facility is not used, the pin should be left open circuit.

FEATURES

- Trimmable output
- Excellent temperature stability
- Low output noise figure
- Available in two temperature ranges
- 1 and 2% initial voltage tolerance versions available
- No external stabilising capacitor required in most cases
- Low slope resistance
- TO18 package
- SOT223 and SO8 small outline packages

SCHEMATIC DIAGRAM

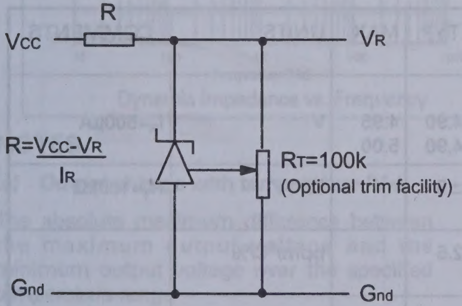


Figure 1:
This circuit will allow the reference to be trimmed over a wide range. The device is specified over a ±5% trim range.

CONNECTION TABLE

Pin	SO8	SOT223	TO18
1	Trim	Trim	VR
2	N/C	Gnd	Trim
3	N/C	VR	Gnd
4	Gnd	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	VR	–	–
Pack	N8	G	–

see Diagrams Page 1 - 8

ZRT050

ABSOLUTE MAXIMUM RATING

Reverse Current	60mA ø
Operating Temperature	
A grade	-55°C to 125°C
C grade	0°C to 70°C
Storage Temperature	
TO18	-55 °C to 175 °C
SO8, SOT223	-55 °C to 125 °C

Power Dissipation (T_{amb}=25°C)

TO18	300mW
SO8	625mW
SOT223	2W

ø Above 25°C this figure should be linearly derated to 12mA at 125°C

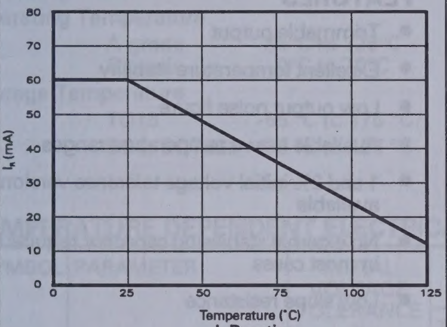
TEMPERATURE DEPENDENT ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	INITIAL VOLTAGE TOLERANCE %	GRADE A -55°C TO 125°C		GRADE C 0°C TO 70°C		UNITS
			TYP	MAX	TYP	MAX	
ΔV_R	Output voltage change over relevant temperature range (See note (a))	1 & 2	13.5	45.0	5.4	17.2	mV
T_CV_R	Output voltage temperature coefficient (See note (b))	1 & 2	15.0	50.0	15.0	50.0	ppm/°C

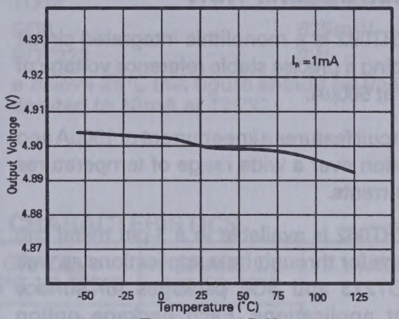
ELECTRICAL CHARACTERISTICS
(at T_{amb}=25°C and Pin 2 o/c unless otherwise stated)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	COMMENTS
V_R	Output voltage 1% tolerance (A1,C1) 2% tolerance (C2)	 4.85 4.80	 4.90 4.90	 4.95 5.00	V	I_R=500μA
ΔV_{TRIM}	Output voltage adjustment range		±5		%	R_T=100kΩ
$T_C\Delta V_{TRIM}$	Change in TCV_R with output adjustment		2.5		ppm/°C/%	
I_R	Operating current range	0.15		60	mA	See note (c)
t_{on} t_{off}	Turn-on time Turn-off time		100 0.3		μs	R_L=1kΩ
e_{np-p}	Output voltage noise (over the range 0.1 to 10Hz)		50		μV	Peak to peak measurement
R_S	Slope resistance		1.25	2.0	Ω	I_R 0.5mA to 5mA See note (d)

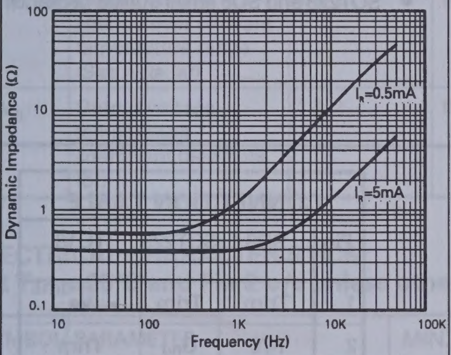
TYPICAL CHARACTERISTICS



I_R Derating



Temperature Drift



Dynamic Impedance vs. Frequency

NOTES

(a) Output change with temperature (V_R)

The absolute maximum difference between the maximum output voltage and the minimum output voltage over the specified temperature range

$$\Delta V_R = V_{max} - V_{min}$$

(b) Output temperature coefficient ($T_C V_R$)

The ratio of the output change with temperature to the specified temperature range expressed in ppm/°C

$$T_c V_R = \frac{\Delta V_R \times 10^6}{V_R \times \Delta T} \ ppm/°C$$

ΔT= Full temperature range

(c) Operating current (I_R)

Maximum operating current must be derated as indicated in maximum ratings.

(d) Slope resistance (R_S)

The slope resistance is defined as :

$$R_S = \frac{\text{change in } V_R}{\text{specified current range}}$$

$\Delta I = 5 - 0.5 = 4.5mA$ (typically)

(e) Line regulation

The ratio of change in output voltage to the change in input voltage producing it.

$$\frac{R_S \times 100}{V_R \times R_{source}} \ \%/V$$

6.2V LOW POWER
PRECISION REFERENCE SOURCE

ZRT062

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRT062 is a monolithic integrated circuit providing a precise stable reference voltage of 6.17V at 500µA.

The circuit features a knee current of 150µA and operation over a wide range of temperatures and currents.

The ZRT062 is available in a 3-pin metal can package for through hole applications as well as SOT223 and SO8 packages for surface mount applications. Each package option offers a trim facility whereby the output voltage can be adjusted as shown in Fig.1. This facility is used when compensating for system errors or setting the reference output to a particular value. When the trim facility is not used, the pin should be left open circuit.

FEATURES

- Trimmable output
- Excellent temperature stability
- Low output noise figure
- Available in two temperature ranges
- 1 and 2% initial voltage tolerance versions available
- No external stabilising capacitor required in most cases
- Low slope resistance
- TO18 package
- SOT223 and SO8 small outline packages

SCHEMATIC DIAGRAM

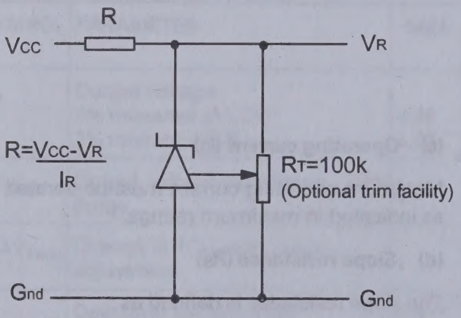


Figure 1:
This circuit will allow the reference to be trimmed over a wide range. The device is specified over a ±5% trim range.

CONNECTION TABLE

Pin	SO8	SOT223	TO18
1	Trim	Trim	V_R
2	N/C	G_{nd}	Trim
3	N/C	V_R	G_{nd}
4	G_{nd}	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	V_R	–	–
Pack	N8	G	–
see Diagrams Page 1 - 8			

ABSOLUTE MAXIMUM RATING

Reverse Current	50mA ø
Operating Temperature	
A grade	-55°C to 125°C
C grade	0°C to 70°C
Storage Temperature	
TO18	-55 °C to 175 °C
SO8, SOT223	-55 °C to 125 °C

Power Dissipation (T_{amb}=25°C)

TO18	300mW
SO8	625mW
SOT223	2W

ø Above 25°C this figure should be linearly derated to 10mA at 125°C

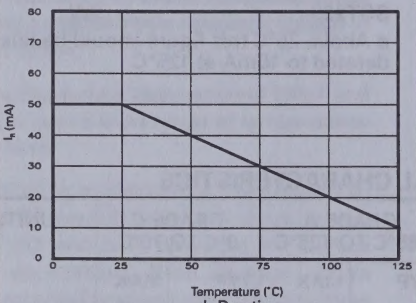
TEMPERATURE DEPENDENT ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	INITIAL VOLTAGE TOLERANCE %	GRADE A -55°C TO 125°C		GRADE C 0°C TO 70°C		UNITS
			TYP	MAX	TYP	MAX	
ΔV_R	Output voltage change over relevant temperature range (See note (a))	1 & 2	15.0	40.0	6.5	22.0	mV
T_CV_R	Output voltage temperature coefficient (See note (b))	1 & 2	15.0	40.0	15.0	50.0	ppm/°C

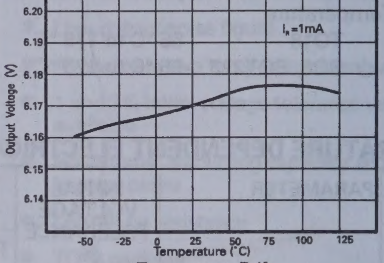
ELECTRICAL CHARACTERISTICS
(at T_{amb}=25°C and Pin 2 o/c unless otherwise stated)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	COMMENTS
V_R	Output voltage 1% tolerance (A1,C1) 2% tolerance (C2)	 6.11 6.05	 6.17 6.17	 6.23 6.29	 V	 I_R=500μA
ΔV_{TRIM}	Output voltage adjustment range		±5		%	R_T=100kΩ
$T_C\Delta V_{TRIM}$	Change in T_CV_R with output adjustment		5.0		ppm/°C/%	
I_R	Operating current range	0.15		50	mA	See note (c)
t_{on} t_{off}	Turn-on time Turn-off time		250 0.3		μs	R_L=1kΩ
e_{np-p}	Output voltage noise (over the range 0.1 to 10Hz)		50		μV	Peak to peak measurement
R_S	Slope resistance		1.4	3.0	Ω	I_R 0.5mA to 5mA See note (d)

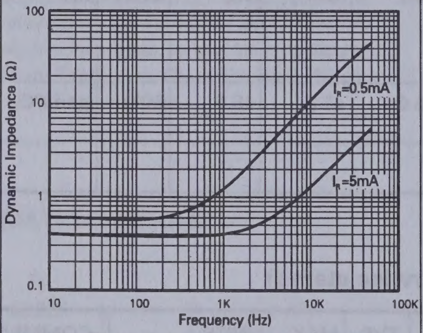
TYPICAL CHARACTERISTICS



I_R Derating



Temperature Drift



Dynamic Impedance vs. Frequency

NOTES

(a) Output change with temperature (V_R)

The absolute maximum difference between the maximum output voltage and the minimum output voltage over the specified temperature range

$$\Delta V_R = V_{max} - V_{min}$$

(b) Output temperature coefficient ($T_C V_R$)

The ratio of the output change with temperature to the specified temperature range expressed in ppm/°C

$$T_c V_R = \frac{\Delta V_R \times 10^6}{V_R \times \Delta T}\ ppm/°C$$

ΔT= Full temperature range

(c) Operating current (I_R)

Maximum operating current must be derated as indicated in maximum ratings.

(d) Slope resistance (R_S)

The slope resistance is defined as :

$$R_S = \frac{change\ in\ V_R}{specified\ current\ range}$$

$\Delta I = 5 - 0.5 = 4.5mA$ *(typically)*

(e) Line regulation

The ratio of change in output voltage to the change in input voltage producing it.

$$\frac{R_S \times 100}{V_R \times R_{source}}\ \%/V$$

9.8V LOW POWER PRECISION REFERENCE SOURCE

ZRT100

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZRT100 is a monolithic integrated circuit providing a precise stable reference voltage of 9.8V at 500μA.

The circuit features a knee current of 150μA and operation over a wide range of temperatures and currents.

The ZRT100 is available in a 3-pin metal can package for through hole applications as well as SOT223 and SO8 packages for surface mount applications. Each package option offers a trim facility whereby the output voltage can be adjusted as shown in Fig.1. This facility is used when compensating for system errors or setting the reference output to a particular value. When the trim facility is not used, the pin should be left open circuit.

FEATURES

- Trimmable output
- Excellent temperature stability
- Low output noise figure
- Available in two temperature ranges
- 1 and 2% initial voltage tolerance versions available
- No external stabilising capacitor required in most cases
- Low slope resistance
- TO18 package
- SOT223 and SO8 small outline packages

SCHEMATIC DIAGRAM

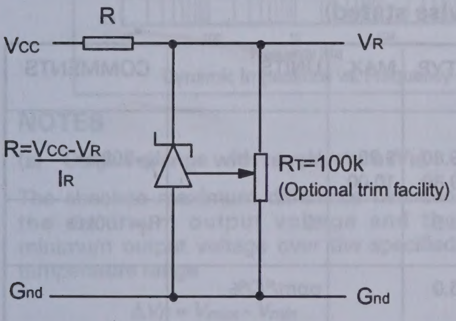


Figure 1:
This circuit will allow the reference to be trimmed over a wide range. The device is specified over a ±5% trim range.

CONNECTION TABLE

Pin	SO8	SOT223	TO18
1	Trim	Trim	VR
2	N/C	Gnd	Trim
3	N/C	VR	Gnd
4	Gnd	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	VR	–	–
Pack	N8	G	–
see Diagrams Page 1 - 8			

ZRT100

ABSOLUTE MAXIMUM RATING

Reverse Current	30mA ø
Operating Temperature	
A grade	-55°C to 125°C
C grade	0°C to 70°C
Storage Temperature	
TO18	-55 °C to 175 °C
SO8, SOT223	-55 °C to 125 °C

Power Dissipation (T_{amb}=25°C)	
TO18	300mW
SO8	625mW
SOT223	2W

ø Above 25°C this figure should be linearly derated to 6mA at 125°C

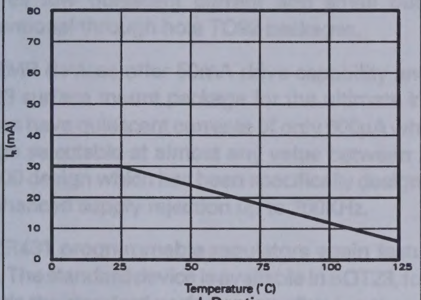
TEMPERATURE DEPENDENT ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	INITIAL VOLTAGE TOLERANCE %	GRADE A -55°C TO 125°C		GRADE C 0°C TO 70°C		UNITS
			TYP	MAX	TYP	MAX	
ΔV_R	Output voltage change over relevant temperature range (See note (a))	1 & 2	27.0	90.0	10.8	34.4	mV
T_CV_R	Output voltage temperature coefficient (See note (b))	1 & 2	15.0	50.0	15.0	50.0	ppm/°C

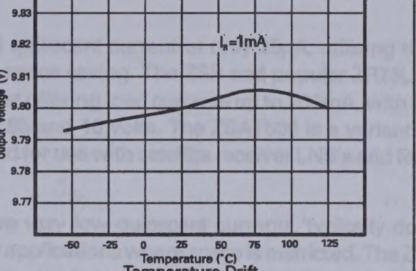
ELECTRICAL CHARACTERISTICS
(at T_{amb}=25°C and Pin 2 o/c unless otherwise stated)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	COMMENTS
V_R	Output voltage 1% tolerance (A1,C1) 2% tolerance (C2)	 9.70 9.60	 9.80 9.80	 9.90 10.00	 V	 I_R=500μA
ΔV_{TRIM}	Output voltage adjustment range		±5		%	R_T=100kΩ
$T_C\Delta V_{TRIM}$	Change in TCV_R with output adjustment		5.0		ppm/°C/%	
I_R	Operating current range	0.15		30	mA	See note (c)
t_{on} t_{off}	Turn-on time Turn-off time		400 0.3		μs	R_L=1kΩ
e_{np-p}	Output voltage noise (over the range 0.1 to 10Hz)		50		μV	Peak to peak measurement
R_S	Slope resistance		1.8	4.0	Ω	I_R 0.5mA to 5mA See note (d)

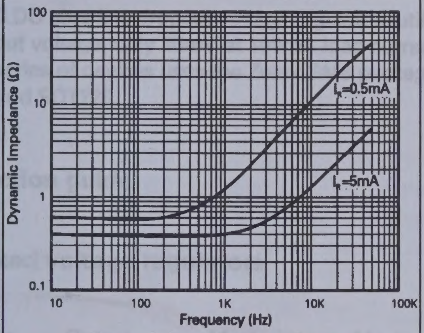
TYPICAL CHARACTERISTICS



I_R Derating



Temperature Drift



Dynamic Impedance vs. Frequency

NOTES

(a) Output change with temperature (V_R)

The absolute maximum difference between the maximum output voltage and the minimum output voltage over the specified temperature range

$$\Delta V_R = V_{max} - V_{min}$$

(b) Output temperature coefficient ($T_C V_R$)

The ratio of the output change with temperature to the specified temperature range expressed in ppm/°C

$$T_c V_R = \frac{\Delta V_R \times 10^6}{V_R \times \Delta T}\ ppm/°C$$

ΔT= Full temperature range

(c) Operating current (I_R)

Maximum operating current must be derated as indicated in maximum ratings.

(d) Slope resistance (R_S)

The slope resistance is defined as :

$$R_S = \frac{change\ in\ V_R}{specified\ current\ range}$$

$\Delta I = 5 - 0.5 = 4.5mA$ *(typically)*

(e) Line regulation

The ratio of change in output voltage to the change in input voltage producing it.

$$\frac{R_S \times 100}{V_R \times R_{source}}\ \%/V$$

Section 2

Voltage Regulators

This range of devices has been designed with low power and space saving in mind. Each series features low quiescent current and small outline surface mount packaging as well as more conventional through hole TO92 packages.

The ZMR devices offer 50mA drive capability and quiescent current of only 25µA, utilising the tiny SOT23 surface mount package for the ultimate in space saving. The ZSR and popular ZR78L series devices have quiescent currents of only 600µA whilst offering load currents up to 200mA, with output voltage selectable at almost any value between 2.85 and 10 volts. The ZSAT500 is a variant of the ZSR500 design which has been specifically designed for use with satellite receiver LNB's and features an enhanced supply rejection up to 200KHz.

The ZR431 programmable regulators again feature very low quiescent currents, typically down to 35µA. The standard device is available in SOT23, for applications where space is restricted. The ZR2431 extends the standard performance allowing the output voltage to be set down to 1.25 volts.

The ZLDO ultra low dropout voltage regulators utilise exceptional performance to provide the lowest dropout voltage, only 30mV at 100mA load current, particularly important for battery applications. This series of devices uses the Zetex SM8 package which is an 8 pin enhancement of the industry standard SOT223.

Selection guide

1. Fixed voltage regulators

Part No	Output Voltage (V)	Maximum Output Current (mA)	Maximum Quiescent Current (µA)	Typical Dropout Voltage (V)	Maximum Line Regulation (mV)	Maximum Load Regulation (mV)
ZMR250	2.5	50	40	1.7	15	30
ZMR500	5	50	70	1.7	15	40
ZSR285	2.85	200	600	1.7	30	25
ZSR300	3	200	600	1.7	30	25
ZSR330	3.3	200	600	1.7	30	25
ZSR400	4	200	600	1.7	40	25
ZSR500	5	200	600	1.7	40	25
ZSR570	5.7	200	600	1.7	40	30
ZSR600	6	200	600	1.7	40	30
ZSR800	8	200	600	1.7	40	30
ZSR900	9	200	600	1.7	40	30
ZSR1000	10	200	600	1.7	40	30
ZR78L028	2.85	200	600	1.7	30	25

1. Fixed voltage regulators (continued)

Part No	Output Voltage (V)	Maximum Output Current (mA)	Maximum Quiescent Current (µA)	Typical Dropout Voltage (V)	Maximum Line Regulation (mV)	Maximum Load Regulation (mV)
ZR78L03	3	200	600	1.7	30	25
ZR78L033	3.3	200	600	1.7	30	25
ZR78L04	4	200	600	1.7	40	25
ZR78L05	5	200	600	1.7	40	25
ZR78L057	5.7	200	600	1.7	40	30
ZR78L06	6	200	600	1.7	40	30
ZR78L08	8	200	600	1.7	40	30
ZR78L09	9	200	600	1.7	40	30
ZR78L10	10	200	600	1.7	40	30
ZSAT500	5	200	600	1.7	40	30

2. Programmable voltage regulators

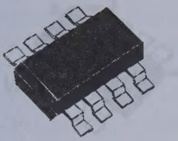
Part No	Reference Voltage (V)	Minimum Output Voltage (V)	Maximum Output Voltage (V)	Minimum Cathode Current (µA)	Maximum Cathode Current (mA)
ZR431	2.5	2.5	20	50	100
ZR2431*	1.22	1.25	20	100	10

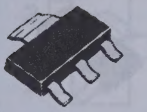
* Advanced Information

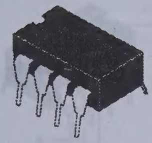
3. Ultra low dropout voltage regulators

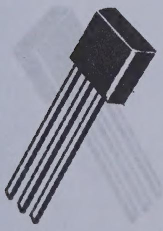
Part No	Output Voltage (V)	Dropout Voltage @100mA (mV)	Maximum Load Current (mA)	Typical Quiescent Current (µA)	Typical Shutdown Current (µA)	Typical Load Regulation (mV/V)
ZLDO330	3.3	30	600	11	66	3.3
ZLDO485	4.85	30	600	11	97	4.85
ZLDO500	5	30	600	11	100	5

Voltage Regulator Ordering Information





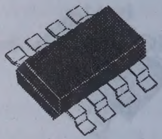


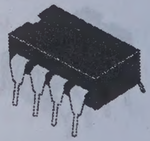


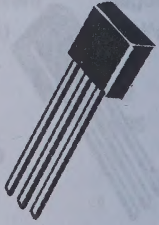
Part Number	Package	Part Mark
ZMR250F	SOT23	25K
ZMR250C	TO92	ZMR250
ZMR500F	SOT23	50K
ZMR500C	TO92	ZMR500
ZR431N8	SO8	ZR431
ZR431N801	SO8	ZR43101
ZR431G	SOT223	ZR431
ZR431G01	SOT223	ZR43101
ZR431F	SOT23	43A
ZR431F01	SOT23	43B
ZR431C	TO92	ZR431
ZR431C01	TO92	ZR43101
ZR2431N8	SO8	ZR2431
ZR2431G	SOT223	ZR2431
ZR2431C	TO92	ZR2431
ZSR285N8	SO8	ZSR285
ZSR285G	SOT223	ZSR285
ZSR285C	TO92	ZSR285
ZSR300N8	SO8	ZSR300
ZSR300G	SOT223	ZSR300
ZSR300C	TO92	ZSR300
ZSR330N8	SO8	ZSR330
ZSR330G	SOT223	ZSR330
ZSR330C	TO92	ZSR330
ZSR400N8	SO8	ZSR400
ZSR400G	SOT223	ZSR400
ZSR400C	TO92	ZSR400
ZSR500N8	SO8	ZSR500
ZSR500G	SOT223	ZSR500
ZSR500C	TO92	ZSR500
ZSR570N8	SO8	ZSR570
ZSR570G	SOT223	ZSR570
ZSR570C	TO92	ZSR570
ZSR600N8	SO8	ZSR600
ZSR600G	SOT223	ZSR600
ZSR600C	TO92	ZSR600
ZSR800N8	SO8	ZSR800
ZSR800G	SOT223	ZSR800
ZSR800C	TO92	ZSR800
ZSR900N8	SO8	ZSR900

Voltage Regulator Ordering Information (continued)

Part Number	Package	Part Mark
ZSR900G	SOT223	ZSR900
ZSR900C	TO92	ZSR900
ZSR1000N8	SO8	ZSR100
ZSR1000G	SOT223	ZSR100
ZSR1000C	TO92	ZSR100
ZR78L028G	SOT223	ZR78L028
ZR78L028C	TO92	ZR78L028
ZR78L03G	SOT223	ZR78L03
ZR78L03C	TO92	ZR78L03
ZR78L033G	SOT223	ZR78L033
ZR78L033C	TO92	ZR78L033
ZR78L04G	SOT223	ZR78L04
ZR78L04C	TO92	ZR78L04
ZR78L05G	SOT223	ZR78L05
ZR78L05C	TO92	ZR78L05
ZR78L057G	SOT223	ZR78L057
ZR78L057C	TO92	ZR78L057
ZR78L06G	SOT223	ZR78L06
ZR78L06C	TO92	ZR78L06
ZR78L08G	SOT223	ZR78L08
ZR78L08C	TO92	ZR78L08
ZR78L09G	SOT223	ZR78L09
ZR78L09C	TO92	ZR78L09
ZR78L10G	SOT223	ZR78L10
ZR78L10C	TO92	ZR78L10
ZSAT500N8	SO8	ZSAT500
ZSAT500G	SOT223	ZSAT500
ZSAT500C	TO92	ZSAT500
ZLDO330T8	SM8	ZLDO330
ZLDO485T8	SM8	ZLDO485
ZLDO500T8	SM8	ZLDO500

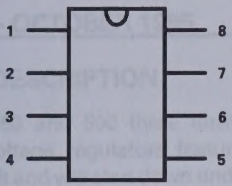






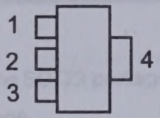
Voltage Regulator Connection Diagrams

SO8 Package Suffix – N8



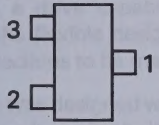
Top View

SOT223 Package Suffix – G



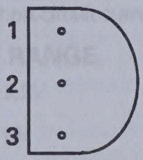
Top View –
Pin 4 floating or connected to pin 2

SOT23 Package Suffix – F



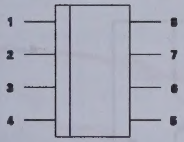
Top View

TO92 Package Suffix – C



Bottom View

SM8 Package Suffix – T8



Top View –
Pin 6 must be left floating

FIXED 2.5 AND 5 VOLT MINATURE VOLTAGE REGULATORS

ZMR250
ZMR500

ISSUE 2 - OCTOBER 1995

DEVICE DESCRIPTION

The ZMR250 and 500 three terminal fixed positive voltage regulators feature internal current limit and will shut down under thermal overload conditions making the devices almost impossible to destroy.

The circuit design offers an exceptionally small quiescent current, only 30µA for the 2.5 volt device, ideal for low power applications. The initial devices in the series regulate to 2.5 or 5 volts with a drive capability up to 50mA, however, the flexible design will allow other voltage selections to be made.

The device was designed with space saving in mind and so is available in the small outline SOT23 package. This tiny package is ideal for applications where space is restricted. The device is also available in the through hole TO92 package.

FEATURES

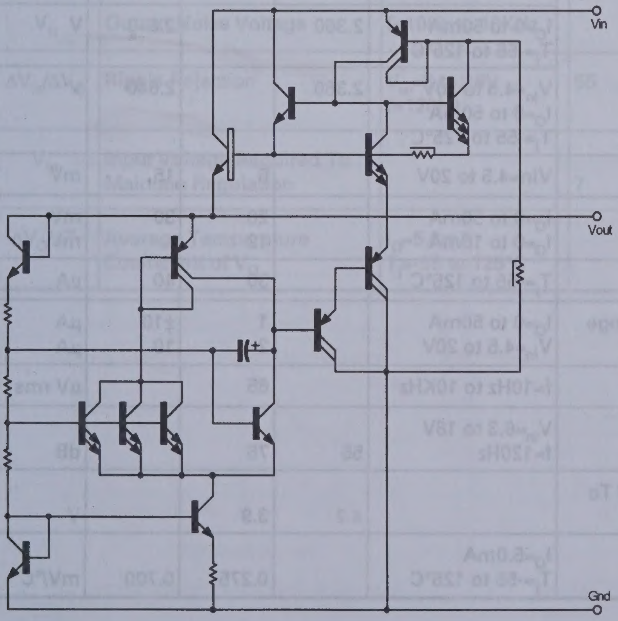
- Small outline SOT23 package
- TO92 package
- 2.5V and 5V
- Output current up to 50mA
- Very low Quiesent current (30µA)
- Unconditionally stable
- Other output voltages possible
- Internal short circuit current limit

VOLTAGE RANGE

ZMR250	2.5V
ZMR500	5V

Contact Zetex Marketing for availability of other voltages

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SOT223	TO92
1	G_{nd}	In
2	In	G_{nd}
3	Out	Out
Pack	F	C
see Diagrams Page 2 - 5		

ZMR250
ZMR500

ABSOLUTE MAXIMUM RATINGS

Input voltage	20V	
Package power dissipation	SOT23	500mW (Note 3)
(T_{amb}=25 °C)	TO92	600mW
Output current (I_O)		200mA
Operating temperature		-55 to 125°C
Storage temperature		-65 to 150°C

Note:

1. The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at 25 °C and must be linearly derated to zero at T_{amb}=125°C.

2. The following data represents pulse test conditions with junction temperatures as indicated at the initiation of the test. Continuous operation of the devices with the stated conditions might exceed the power dissipation limits of the chosen package.

3. Maximum power dissipation, for the SOT23 package, is calculated assuming that the device is mounted on a ceramic substrate measuring 15 x 15 x 0.6mm.

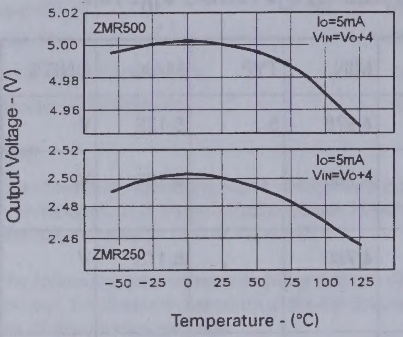
ZMR250
ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=10mA, V_{in}=6.5V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		2.438	2.5	2.563	V
		I_O=0 to 50mA T_j=-55 to 125°C	2.360		2.640	V
		V_{in}=4.5 to 20V I_O=0 to 50mA T_j=-55 to 125°C	2.360		2.640	V
ΔV_O	Line Regulation	Vin=4.5 to 20V		5	15	mV
ΔV_O	Load Regulation	I_O=0 to 50mA I_O=0 to 10mA		20 12	30	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		30	40	µA
ΔI_q	Quiescent Current Change	I_O=0 to 50mA V_{in}=4.5 to 20V		1 2	±10 10	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		65		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=6.3 to 18V f=120Hz	55	75		dB
V_{in}	Input Voltage Required To Maintain Regulation		4.2	3.9		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA T_j=-55 to 125°C		0.275	0.700	mV/°C

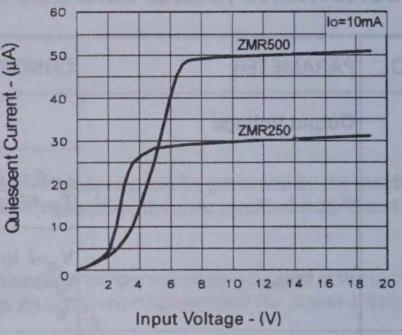
ZMR500
ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=10mA, V_{in}=10V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		4.875	5	5.125	V
		I_O=0 to 50mA T_j=-55 to 125°C	4.780		5.160	V
		V_{in}=7 to 20V I_O=0 to 50mA T_j=-55 to 125°C	4.780		5.175	V
ΔV_O	Line Regulation	V_{in}=7 to 20V		5	15	mV
ΔV_O	Load Regulation	I_O=0 to 50mA I_O=0 to 10mA		25 15	40	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		50	70	μA
ΔI_q	Quiescent Current Change	I_O=0 to 50mA V_{in}=7 to 20V		1 2	±10 10	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		90		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8 to 18V f=120Hz	55	72		dB
V_{in}	Input Voltage Required To Maintain Regulation		7	6.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA T_j=-55 to 125°C		0.275	0.700	mV/°C

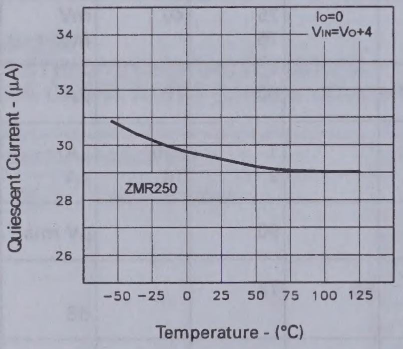
TYPICAL CHARACTERISTICS



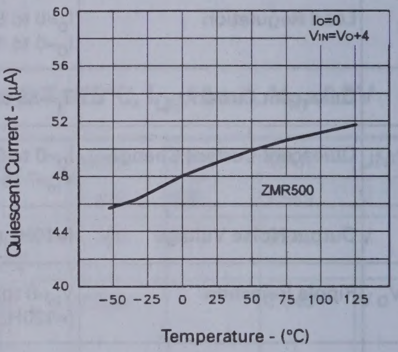
Output Voltage v Temperature Coefficient



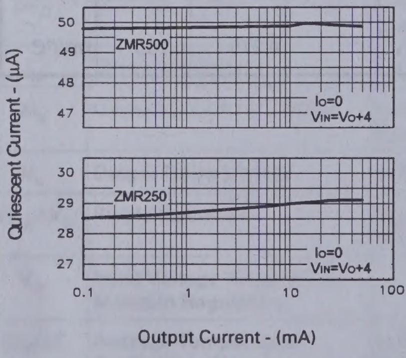
Quiescent Current v Input Voltage



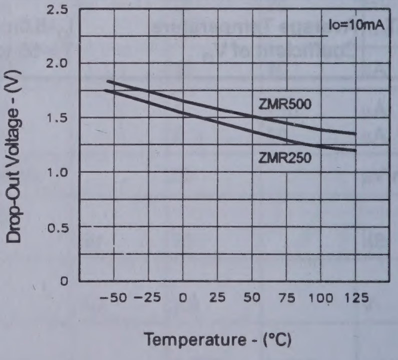
Quiescent Current v Temperature



Quiescent Current v Temperature

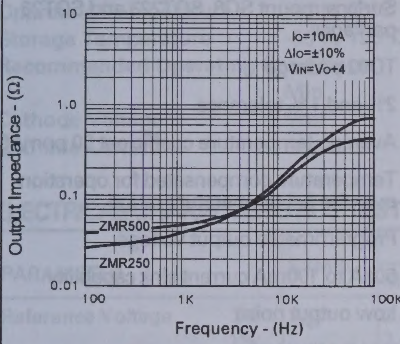


Quiescent Current v Output Current

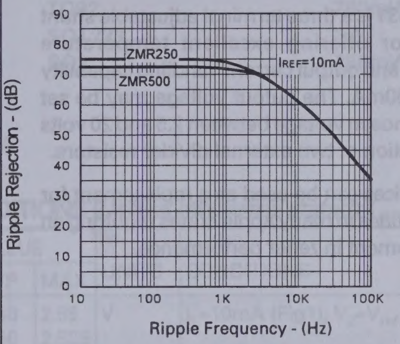


Drop-Out Voltage v Temperature

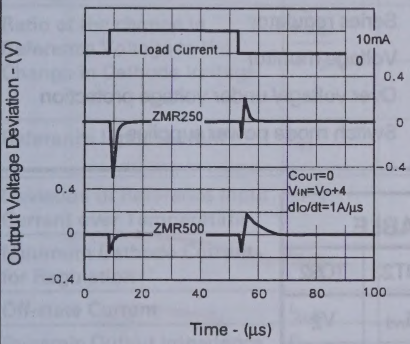
TYPICAL CHARACTERISTICS



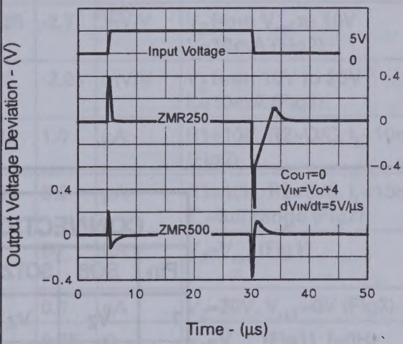
Output Impedance v Frequency



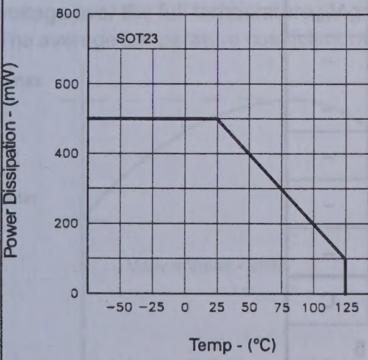
Ripple Rejection v Ripple Frequency



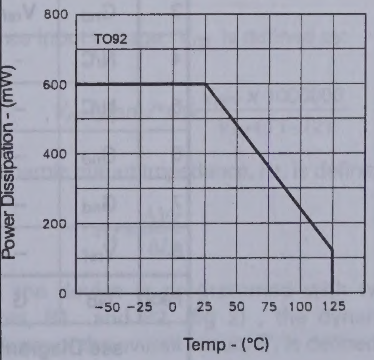
Load Transient Response



Line Transient Response



Power Derating



Power Derating

ADJUSTABLE PRECISION ZENER SHUNT REGULATOR

ZR431

ISSUE 1 – OCTOBER 1995

DEVICE DESCRIPTION

The ZR431 is a three terminal adjustable shunt regulator offering excellent temperature stability and output current handling capability up to 100mA. The output voltage may be set to any chosen voltage between 2.5 and 20 volts by selection of two external divider resistors.

The devices can be used as a replacement for zener diodes in many applications requiring an improvement in zener performance.

FEATURES

- Surface mount SO8, SOT223 and SOT23 packages
- TO92 package
- 2% and 1 % tolerance
- Average temperature coefficient 50 ppm/°C
- Temperature compensated for operation over the full temperature range
- Programmable output voltage
- 50µA to 100mA current sink capability
- Low output noise

APPLICATIONS

- Shunt regulator
- Series regulator
- Voltage monitor
- Over voltage/ under voltage protection
- Switch mode power supplies

CONNECTION TABLE

Pin	SO8	SOT223	SOT23	TO92
1	V_Z	V_Z	Gnd	V_Z
2	Gnd	Gnd	V_Z	Gnd
3	Gnd	V_{ref}	V_{ref}	V_{ref}
4	N/C	-	–	–
5	N/C	–	–	–
6	Gnd	–	–	–
7	Gnd	–	–	–
8	V_{ref}	–	–	–
Pack	N8	G	F	C

see Diagrams Page 2 - 5

ABSOLUTE MAXIMUM RATING

Cathode Voltage (V_Z)	20V
Cathode Current	150mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)	
SOT23	330mW
TO92	780mW
SOT223	2W
SO8	780mW

Recommended Operating Conditions

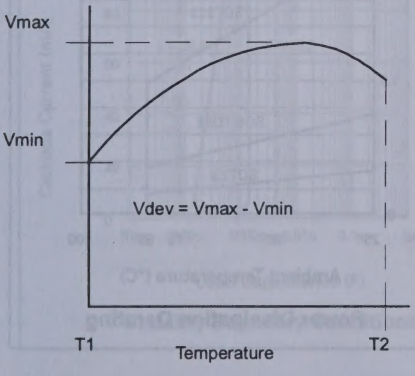
	Min	Max
Cathode Voltage	Vref	20V
Cathode Current	50μA	100mA

ELECTRICAL CHARACTERISTICS TEST CONDITIONS (Unless otherwise stated):T_{amb}=25°C

PARAMETER	SYMBOL	VALUE			UNITS	CONDITIONS
		MIN	TYP	MAX		
Reference Voltage 2% 1%	V_{ref}	2.45 2.475	2.50 2.50	2.55 2.525	V	I_L=10mA (Fig1), V_Z=V_{ref}
Deviation of Reference Input Voltage over Temperature	V_{dev}		8.0	17	mV	I_L=10mA, V_Z=V_{ref} T_a=full range (Fig1)
Ratio of the change in Reference Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{ref}}{\Delta V_Z}$		-1.85	-2.7	mV/V	V_Z from V_{ref} to 10V I_Z=10mA (Fig2)
			-1.0	-2.0	mV/V	V_Z from 10V to 20V I_Z=10mA (Fig2)
Reference Input Current	I_{ref}		0.12	1.0	μA	R1=10K, R2=O/C, I_L=10mA (Fig2)
Deviation of Reference Input Current over Temperature	ΔI_{ref}		0.04	0.2	μA	R1=10K, R2=O/C, I_L=10mA T_a=full range (Fig2)
Minimum Cathode Current for Regulation	I_{Zmin}		35	50	μA	V_Z=V_{ref} (Fig1)
Off-state Current	I_{Zoff}			0.1	μA	V_Z=20V, V_{ref}=0V (Fig3)
Dynamic Output Impedance	R_Z			0.75	Ω	V_Z=V_{ref} (Fig1), f=0Hz

Deviation of reference input voltage, V_{dev}, is defined as the maximum variation of the reference input voltage over the full temperature range.

The average temperature coefficient of the reference input voltage, V_{ref} is defined as:



$$V_{ref}\,(ppm/°C) = \frac{V_{dev} \times 1000000}{V_{ref}\,(T1-T2)}$$

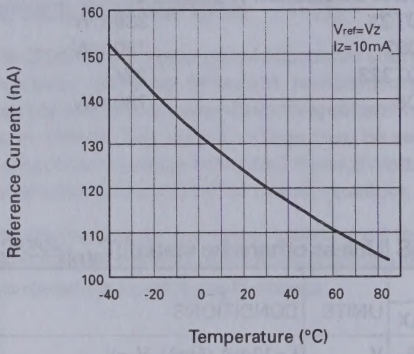
The dynamic output impedance, Rz, is defined as:

$$R_Z = \frac{\Delta V_Z}{\Delta I_Z}$$

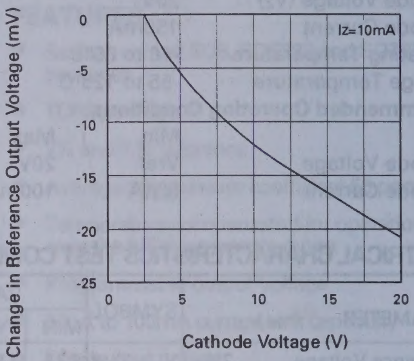
When the device is programmed with two external resistors, R1 and R2, (fig 2), the dynamic output impedance of the overall circuit, R′, is defined as:

$$R' = R_z\left(1+\frac{R1}{R2}\right)$$

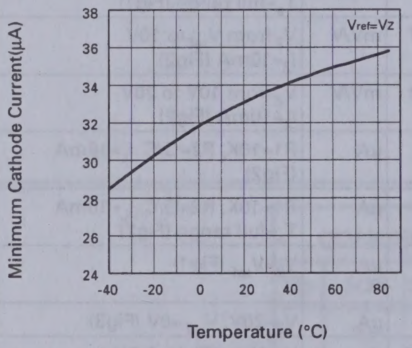
TYPICAL CHARACTERISTICS



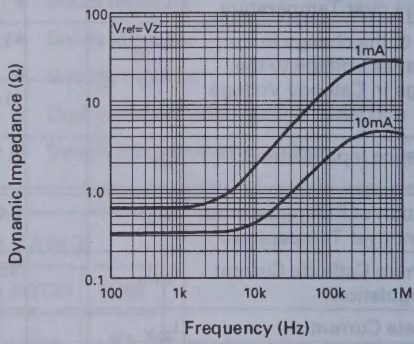
Reference Current v Temperature



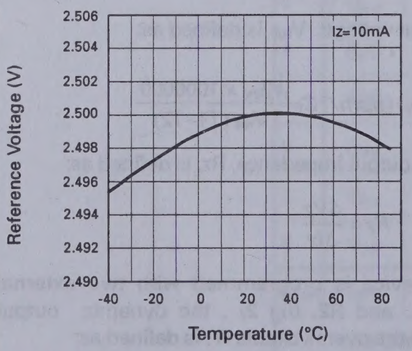
Change in Vref v Cathode Voltage



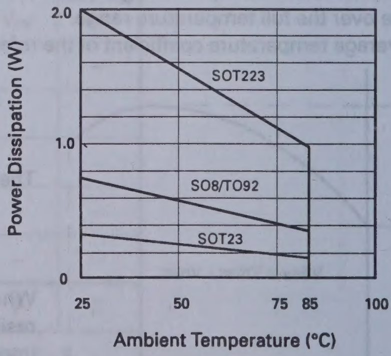
Cathode Current v Temperature



Dynamic Impedance v Frequency

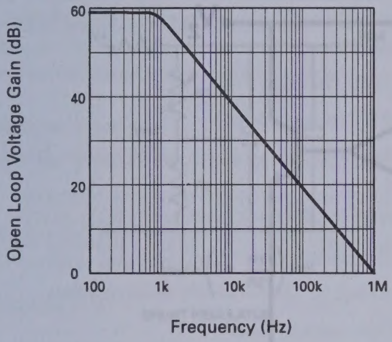


Reference Voltage v Temperature

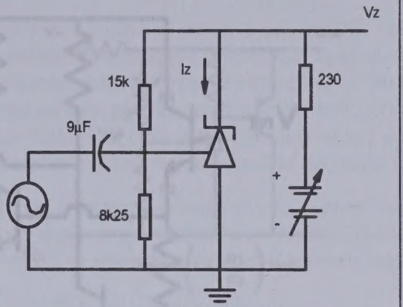


Power Dissipation Derating

TYPICAL CHARACTERISTICS

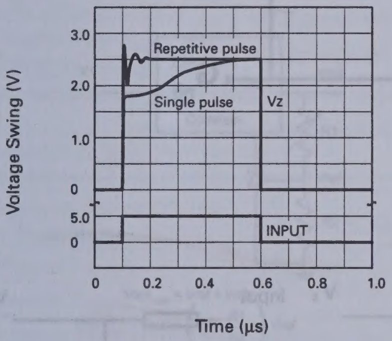


Gain v Frequency

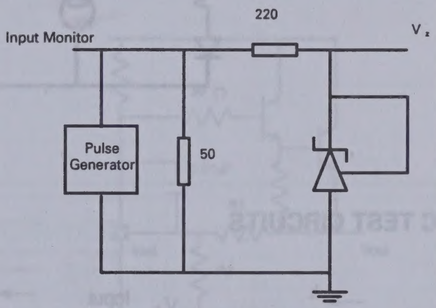

Vz
15k
Iz
230
9µF
+
-
8k25

Iz = 10mA, TA = 25°C

Test Circuit for Open Loop Voltage Gain

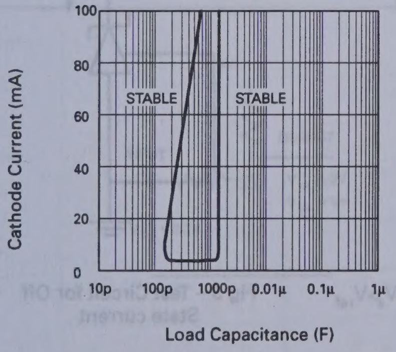


Pulse Response

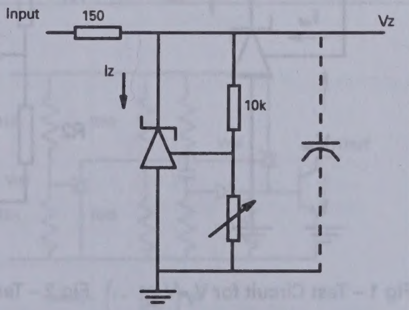

220
Vz
Input Monitor
Pulse Generator
50

TA = 25°C

Test Circuit for Pulse Response



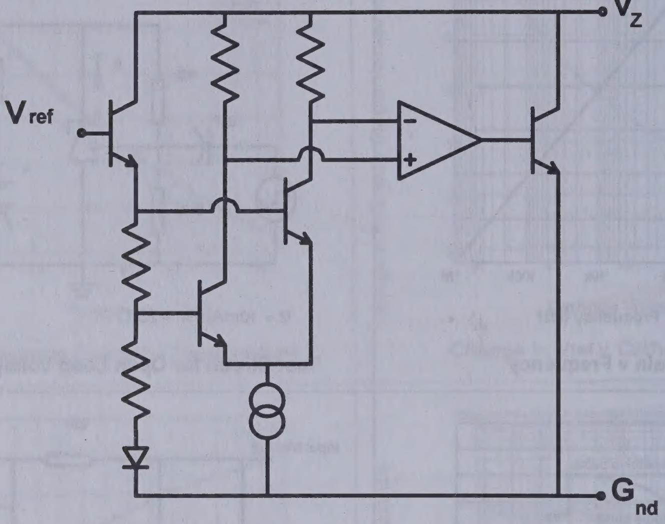
Stability Boundary Conditions


Input
150
Vz
Iz
10k

Vref < Vz < 20, Iz = 10mA, TA = 25°C

Test Circuit for Stability Boundary Conditions

SCHEMATIC DIAGRAM



DC TEST CIRCUITS

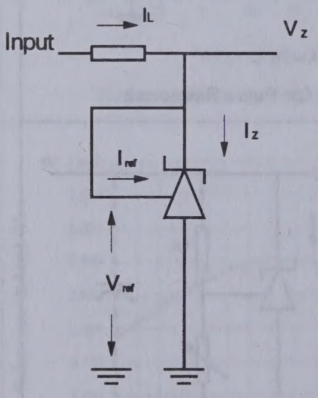

I L
Input
V z
I z
I ref
V ref

Fig 1 – Test Circuit for V_z=V_{ref}

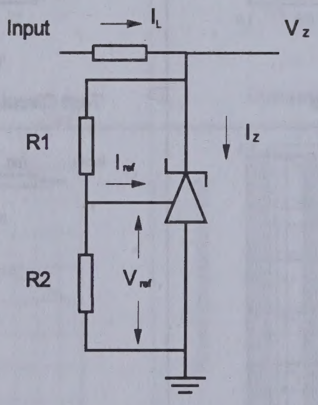

I L
Input
V z
R1
R2
I z
I ref
V ref

Fig 2 – Test Circuit for V_z>V_{ref}

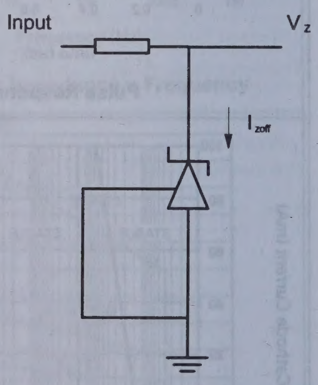
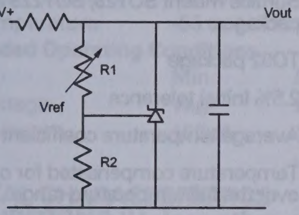

Input
V z
I zoff

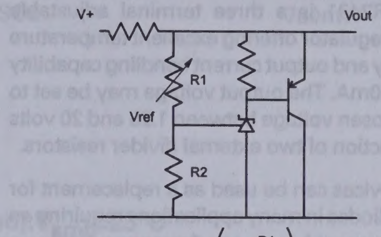
Fig 3 – Test Circuit for Off State current

APPLICATION CIRCUITS


V+
Vout
R1
Vref
R2

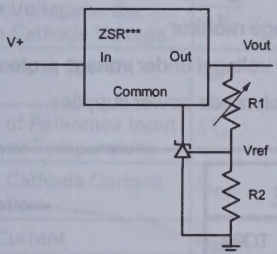
$$V_{out} = \left(1 + \frac{R1}{R2}\right) V_{ref}$$

SHUNT REGULATOR


V+
Vout
R1
Vref
R2

$$V_{out} = \left(1 + \frac{R1}{R2}\right) V_{ref}$$

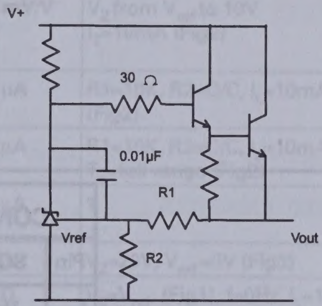
HIGHER CURRENT SHUNT REGULATOR


V+
ZSR***
In
Out
Common
Vout
R1
Vref
R2

$$V_{out\,MIN} = V_{ref} + V_{reg}$$

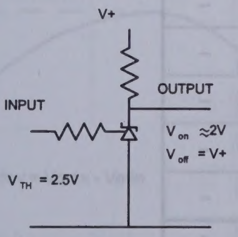
$$V_{out} = \left(1 + \frac{R1}{R2}\right) V_{ref}$$

OUTPUT CONTROL OF A THREE TERMINAL FIXED REGULATOR

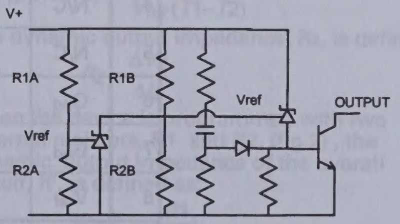

V+
30 Ω
0.01μF
R1
Vref
R2
Vout

$$V_{out} = \left(1 + \frac{R1}{R2}\right) V_{ref}$$

SERIES REGULATOR


V+
INPUT
OUTPUT
V_{on} ≈2V
V_{off} = V+
V_{TH} = 2.5V

SINGLE SUPPLY COMPARATOR WITH TEMPERATURE COMPENSATED THRESHOLD


V+
R1A
R1B
Vref
OUTPUT
Vref
R2A
R2B

$$\text{Low limit} = \left(1 + \frac{R1B}{R2B}\right) V_{ref}$$

$$\text{High limit} = \left(1 + \frac{R1A}{R2A}\right) V_{ref}$$

OVER VOLTAGE / UNDER VOLTAGE PROTECTION CIRCUIT

ADJUSTABLE PRECISION ZENER SHUNT REGULATOR

ZR2431

ADVANCED INFORMATION

DEVICE DESCRIPTION

The ZR2431 is a three terminal adjustable shunt regulator offering excellent temperature stability and output current handling capability up to 10mA. The output voltage may be set to any chosen voltage between 1.25 and 20 volts by selection of two external divider resistors.

The devices can be used as a replacement for zener diodes in many applications requiring an improvement in zener performance.

FEATURES

- Surface mount SOT23, SOT223 and SO8 packages
- TO92 package
- 2.5% Initial tolerance
- Average temperature coefficient 50 ppm/°C
- Temperature compensated for operation over the full temperature range
- Programmable output voltage
- 100µA to 10mA current sink capability
- Low output noise

APPLICATIONS

- Shunt regulator
- Series regulator
- Voltage monitor
- Over voltage/ under voltage protection
- Switch mode power supplies

CONNECTION TABLE

Pin	SO8	SOT223	SOT23	TO92
1	V_Z	V_Z	Gnd	V_Z
2	Gnd	Gnd	V_Z	Gnd
3	Gnd	V_{ref}	V_{ref}	V_{ref}
4	N/C	-	–	–
5	N/C	–	–	–
6	Gnd	–	–	–
7	Gnd	–	–	–
8	V_{ref}	–	–	–
Pack	N8	G	F	C

see Diagrams Page 2 - 5

ABSOLUTE MAXIMUM RATING

Cathode Voltage (V_Z)	20V
Cathode Current	15mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C

Power Dissipation (T_{amb}=25°C)

SOT223	2W
TO92	780mW
SO8	780mW

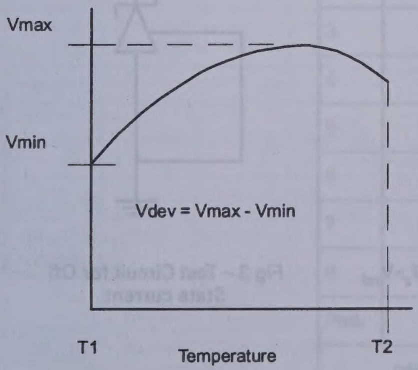
Recommended Operating Conditions

	Min	Max
Cathode Voltage	V_{REF}	20V
Cathode Current	100μA	10mA

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated):T_{amb}=25°C

PARAMETER	SYMBOL	VALUE			UNITS	CONDITIONS
		MIN	TYP	MAX		
Reference Voltage	V_{ref}	1.19	1.22	1.25	V	I_L=10mA (Fig1), V_Z=V_{ref}
Deviation of Reference Input Voltage over Temperature	V_{dev}		4.0	8.0	mV	I_L=10mA, V_Z=V_{ref} T_a=full range (Fig1)
Ratio of the change in Reference Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{ref}}{\Delta V_Z}$		0.5	1.0	mV/V	V_Z from V_{ref} to 10V I_Z=10mA (Fig2)
Reference Input Current	I_{ref}	0.5	0.11	0.2	μA	R1=10K, R2=O/C, I_L=10mA (Fig2)
Deviation of Reference Input Current over Temperature	ΔI_{ref}		0.02	0.2	μA	R1=10K, R2=O/C, I_L=10mA T_a=full range (Fig2)
Minimum Cathode Current for Regulation	I_{Zmin}		40	100	μA	†
Off-state Current	I_{Zoff}		3	10	μA	V_Z=20V, V_{ref}=0V (Fig3)
Dynamic Output Impedance	R_Z		0.5	1.2	Ω	V_Z=V_{ref} (Fig1), f=0Hz, I_L=10mA

Deviation of reference input voltage, V_{dev}, is defined as the maximum variation of the reference input voltage over the full temperature range.



The average temperature coefficient of the reference input voltage, V_{ref} is defined as:

$$V_{ref}\,(ppm/°C) = \frac{V_{dev}\;x\;1000000}{V_{ref}\,(T1-T2)}$$

The dynamic output impedance, Rz, is defined as:

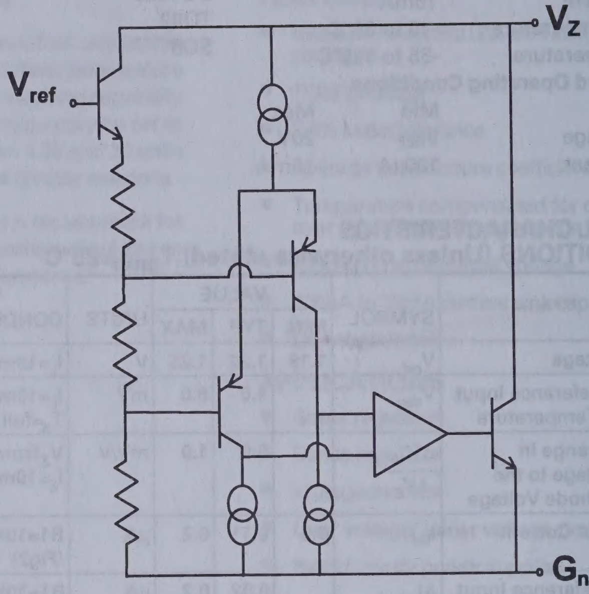
$$R_Z = \frac{\Delta V_Z}{\Delta I_Z}$$

When the device is programmed with two external resistors, R1 and R2, (fig 2), the dynamic output impedance of the overall circuit, R′, is defined as:

$$R' = R_z\,(1+\frac{R1}{R2})$$

† With a capacitance of greater than 100pF between cathode and anode, minimum cathode current must be 0.2mA.

SCHEMATIC DIAGRAM



DC TEST CIRCUITS

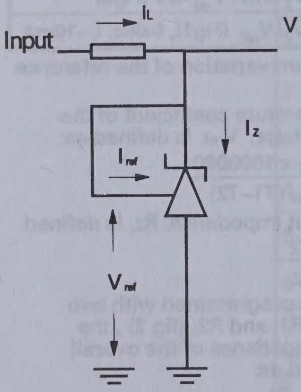

I_L
Input
V_Z
I_Z
I_{ref}
V_{ref}

Fig 1 – Test Circuit for $V_Z=V_{ref}$

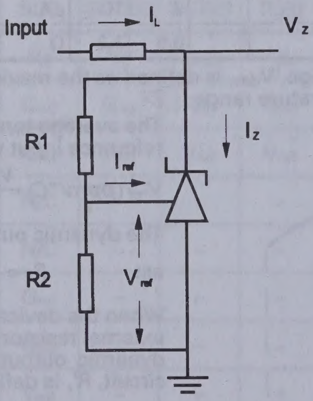

Input
I_L
V_Z
R1
I_Z
I_{ref}
R2
V_{ref}

Fig 2 – Test Circuit for $V_Z>V_{ref}$

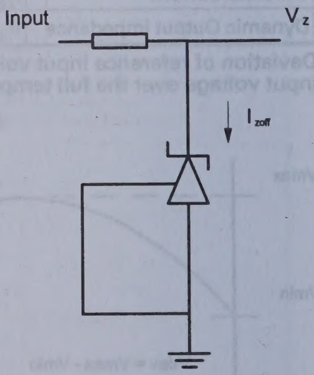

Input
V_Z
I_{zoff}

Fig 3 – Test Circuit for Off State current

2.85 TO 10 VOLT FIXED POSITIVE LOCAL VOLTAGE REGULATOR

ZSR SERIES

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZSR Series three terminal fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices almost impossible to destroy. The circuit design allows creation of any custom voltage in the range 2.85 to 10 volts.The devices are available in small outline surface mount packages, ideal for applications where space saving is important, as well as through hole TO92 style packaging. The devices are suited to local voltage regulation applications, where problems could be encountered with distributed single source regulation, as well as more general voltage regulation applications.

Output voltage change, with input voltage and load current, is much lower than competitive devices. The ZSR devices are completely stable with no external components.

FEATURES

- Small outline SO8 and SOT223 packages
- TO92 package
- 2.85 to 10 Volt
- Output current up to 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125°C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit

VOLTAGE RANGE

ZSR330	3.3V
ZSR500	5V
ZSR600	6V
ZSR800	8V
ZSR1000	10V

Contact Zetex Marketing for availability of other voltages

CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	IN	OUT	IN
2	G_{nd}	G_{nd}	G_{nd}
3	G_{nd}	IN	OUT
4	N/C	–	–
5	N/C	–	–
6	G_{nd}	–	–
7	G_{nd}	–	–
8	OUT	–	–
Pack	N8	G	C

see Diagrams Page 2 - 5

ZSR SERIES

ABSOLUTE MAXIMUM RATING

Input voltage	20V
Output Current(I_o)	200mA
Operating Temperature	-55 to 125°C
Storage Temperature	-65 to 150°C

Power Dissipation (T_{amb}=25°C)

SOT223	2W(Note 3)
TO92	600mW
SO8	780mW(Note 3)

ELECTRICAL CHARACTERISTICS: Notes:

1. The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at 25 °C and must be linearly derated to zero at T_{amb}=125°C.

2. The following data represents pulse test conditions with junction temperatures as indicated at the initiation of the test. Continuous operation of the devices with the stated conditions might exceed the power dissipation limits of the chosen package.

3. Maximum power dissipation, for the SO8 and SOT223 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.

4. The shut down feature of the device operates if its temperature exceeds its design limit as might occur during external faults, short circuits etc. If the regulator is supplied from an inductive source then a large voltage transient, on the regulator input, can result should the shut down circuit operate. It is advised that a capacitor (1µF or greater) should be applied across the regulator input to ensure that the maximum voltage rating of the device is not exceeded under shutdown conditions.

ZSR330
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=7.3V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		3.218	3.3	3.382	V
		I_O=1 to 200mA T_j=-55 to 125°C	3.168		3.432	V
		V_{in}=5.3 to 20V I_O=1 to 100mA T_j=-55 to 125°C	3.168		3.432	V
ΔV_O	Line Regulation	V_{in}=5.3 to 20V		7.5	30	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=5.3 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		50		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=6.3 to 18V f=120Hz	50	64		dB
V_{in}	Input Voltage Required To Maintain Regulation		5.3	5		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA T_j=-55 to 125°C		0.1		mV/°C

ZSR500
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=9V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		4.875	5	5.125	V
		I_O=1 to 200mA T_j=-55 to 125°C	4.8		5.2	V
		V_{in}=7 to 20V I_O=1 to 100mA T_j=-55 to 125°C	4.8		5.2	V
ΔV_O	Line Regulation	V_{in}=7 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		7	6.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA T_j=-55 to 125°C		0.1		mV/°C

ZSR600
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=10V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		5.85	6	6.15	V
		I_O=1 to 200mA T_j=-55 to 125°C	5.76		6.24	V
		V_{in}=8 to 20V I_O=1 to 100mA T_j=-55 to 125°C	5.76		6.24	V
ΔV_O	Line Regulation	V_{in}=8 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		7 2.5	30	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=8 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		90		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=9 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		8	7.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA T_j=-55 to 125°C		0.15		mV/°C

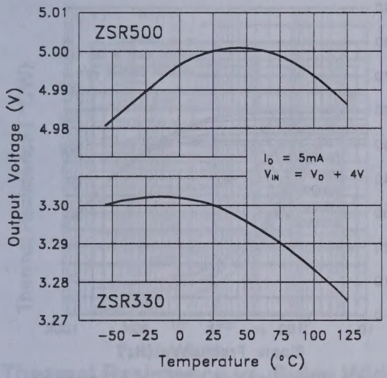
ZSR800
TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=12V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		7.8	8	8.2	V
		I_O=1 to 200mA T_j=-55 to 125°C	7.68		8.32	V
		V_{in}=10 to 20V I_O=1 to 100mA T_j=-55 to 125°C	7.68		8.32	V
ΔV_O	Line Regulation	V_{in}=10 to 20V		11	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		8 3	30	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=10 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		115		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=11 to 18V f=120Hz	44	60		dB
V_{in}	Input Voltage Required To Maintain Regulation		10	9.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA T_j=-55 to 125°C		0.25		mV/°C

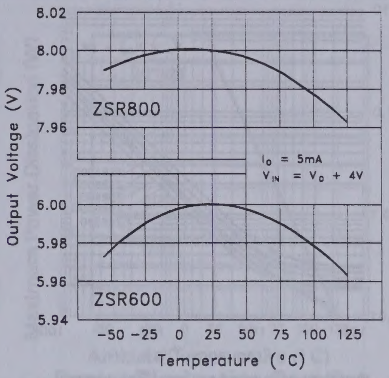
ZSR1000
TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=14V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		9.75	10	10.25	V
		I_O=1 to 200mA T_j=-55 to 125°C	9.6		10.4	V
		V_{in}=12 to 20V I_O=1 to 100mA T_j=-55 to 125°C	9.6		10.4	V
ΔV_O	Line Regulation	V_{in}=12 to 20V		12	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		9 3	30	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=12 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		150		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=13 to 18V f=120Hz	43	57		dB
V_{in}	Input Voltage Required To Maintain Regulation		12	11.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA T_j=-55 to 125°C		0.25		mV/°C

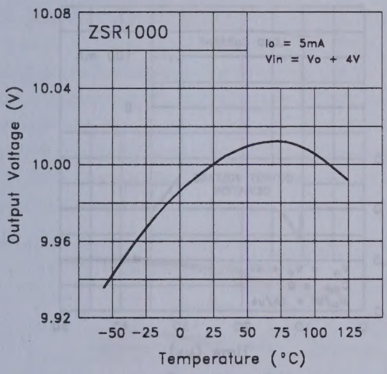
TYPICAL CHARACTERISTICS



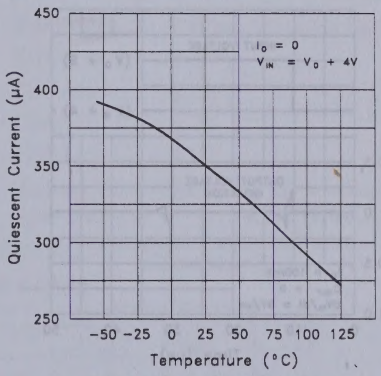
Output Voltage Temperature Coefficient



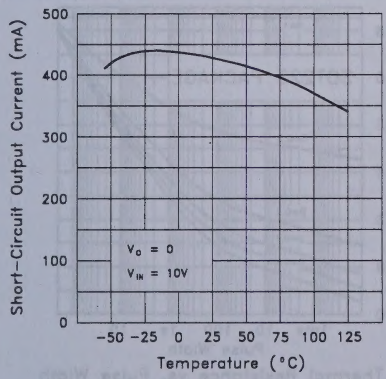
Output Voltage Temperature Coefficient



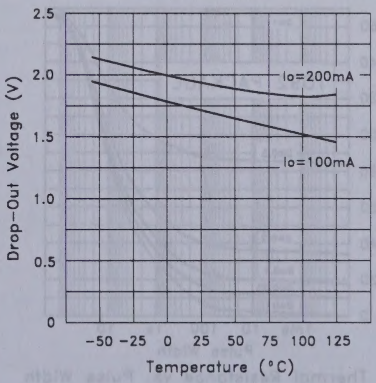
Output Voltage Temperature Coefficient



Quiescent Current vs. Temperature

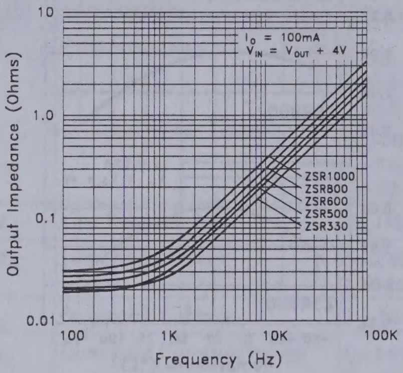


Peak Output Current vs. Temperature

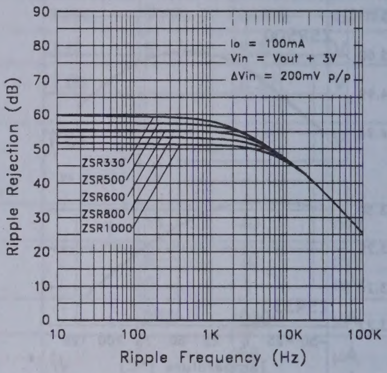


Drop-Out Voltage vs. Temperature

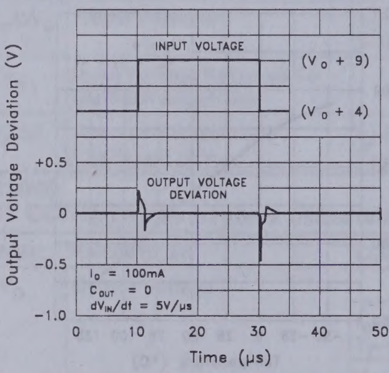
TYPICAL CHARACTERISTICS



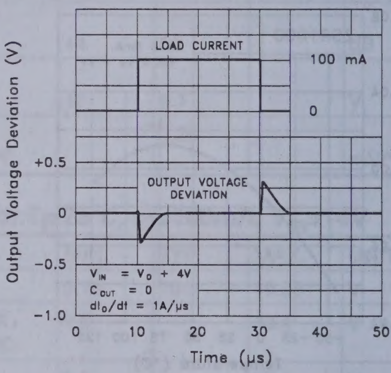
Output Impedance vs. Frequency



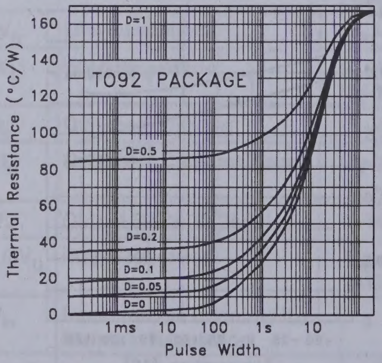
Ripple Rejection vs. Ripple Frequency



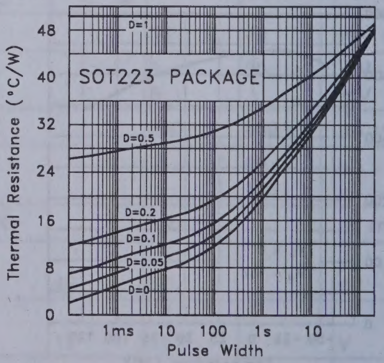
Line Transient Response



Load Transient Response

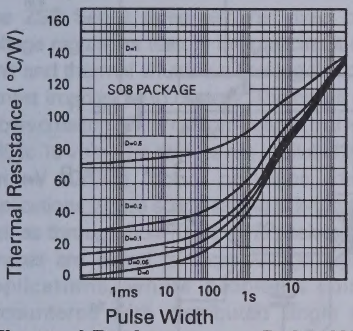


Thermal Resistance vs. Pulse Width

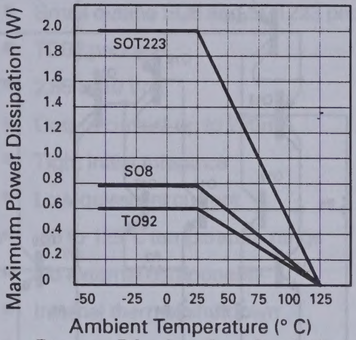


Thermal Resistance vs. Pulse Width

TYPICAL CHARACTERISTICS

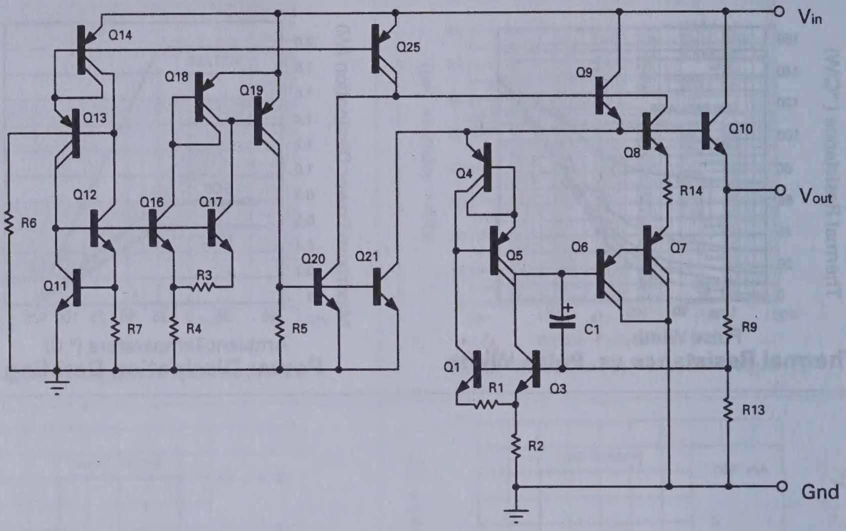


Thermal Resistance vs. Pulse Width



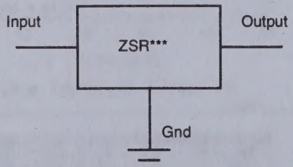
Power Dissipation Derating

SCHEMATIC DIAGRAM

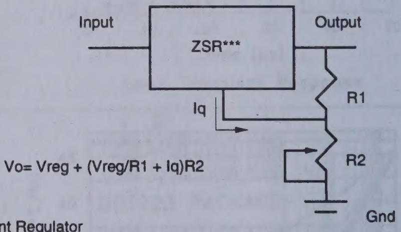

Q14
Q25
Vin
Q18
Q19
Q9
Q13
Q8
Q10
Q4
R14
Vout
Q12
Q16
Q17
R6
Q6
Q7
Q5
Q20
Q21
R3
Q11
R7
R4
R5
C1
R9
Q1
R1
Q3
R13
R2
Gnd

APPLICATIONS

Fixed Output Regulator

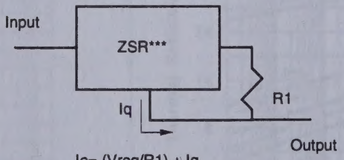

Input
ZSR***
Output
Gnd

Adjustable Output Regulator


Input
ZSR***
Output
Iq
R1
R2
Gnd

Vo= Vreg + (Vreg/R1 + Iq)R2

Current Regulator


Input
ZSR***
Iq
R1
Output

Io= (Vreg/R1) + Iq

2.85 TO 10 VOLT FIXED POSITIVE LOCAL VOLTAGE REGULATOR

ZSR SERIES

ISSUE 1 - DECEMBER 1995

DEVICE DESCRIPTION

The ZSR Series three terminal fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices almost impossible to destroy. The circuit design allows creation of any custom voltage in the range 2.85 to 10 volts.The devices are available in small outline surface mount packages, ideal for applications where space saving is important, as well as through hole TO92 style packaging. The devices are suited to local voltage regulation applications, where problems could be encountered with distributed single source regulation, as well as more general voltage regulation applications.

The ZSR Series show performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350μA. Output voltage change, with input voltage and load current, is much lower than competitive devices. The ZSR devices are completely stable with no external components.

FEATURES

- Small outline SO8 and SOT223 packages
- TO92 package
- 2.85 to 10 Volt
- Output current up to 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125°C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit

VOLTAGE RANGE

ZSR285	2.85V
ZSR300	3.0V
ZSR400	4.0V
ZSR570	5.7V
ZSR900	9.0V

Contact Zetex Marketing for availability of other voltages

CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	IN	OUT	IN
2	Gnd	Gnd	Gnd
3	Gnd	IN	OUT
4	N/C	-	–
5	N/C	–	–
6	Gnd	–	–
7	Gnd	–	–
8	OUT	–	–
Pack	N8	G	C

see Diagrams Page 2 - 5

ABSOLUTE MAXIMUM RATING

Input voltage	20V
Output Current(I_o)	200mA
Operating Temperature	-55 to 125°C
Storage Temperature	-65 to 150°C

Power Dissipation (T_{amb}=25°C)

SOT223	2W(Note 3)
TO92	600mW
SO8	780mW(Note 3)

ELECTRICAL CHARACTERISTICS: Notes:

1. The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at 25 °C and must be linearly derated to zero at T_{amb}=125°C.

2. The following data represents pulse test conditions with junction temperatures as indicated at the initiation of the test. Continuous operation of the devices with the stated conditions might exceed the power dissipation limits of the chosen package.

3. Maximum power dissipation, for the SO8 and SOT223 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.

4. The shut down feature of the device operates if its temperature exceeds its design limit as might occur during external faults, short circuits etc. If the regulator is supplied from an inductive source then a large voltage transient, on the regulator input, can result should the shut down circuit operate. It is advised that a capacitor (1µF or greater) should be applied across the regulator input to ensure that the maximum voltage rating of the device is not exceeded under shutdown conditions.

ZSR285
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=6.85V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		2.78	2.85	2.92	V
		I_O=1 to 200mA τ	2.736		2.964	V
		V_{in}=4.85 to 20V I_O=1 to 100mA τ	2.736		2.964	V
ΔV_O	Line Regulation	V_{in}=4.85 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=4.85 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=5.85 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		4.85	4.55		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ=T_j=-55 to 125°C

ZSR300 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=7V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		2.92	3.0	3.08	V
		I_O=1 to 200mA τ	2.88		3.12	V
		V_{in}=5 to 20V I_O=1 to 100mA τ	2.88		3.12	V
ΔV_O	Line Regulation	V_{in}=5 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=5 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=6 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		5	4.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

ZSR400 TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=8V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		3.9	4.0	4.1	V
		I_O=1 to 200mA τ	3.84		4.16	V
		V_{in}=6 to 20V I_O=1 to 100mA τ	3.84		4.16	V
ΔV_O	Line Regulation	V_{in}=6 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=6 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=7 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		6	5.3		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ = T_j = -55 to 125°C

ZSR570TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=9.7V

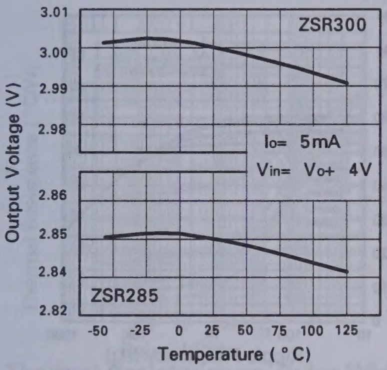
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		5.557	5.7	5.843	V
		I_O=1 to 200mA τ	5.47		5.93	V
		V_{in}=7.7 to 20V I_O=1 to 100mA τ	5.47		5.93	V
ΔV_O	Line Regulation	V_{in}=7.7 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		7 2.5	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7.7 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		90		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8.7 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		7.7	7.4		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.15		mV/°C

ZSR900 TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=13V

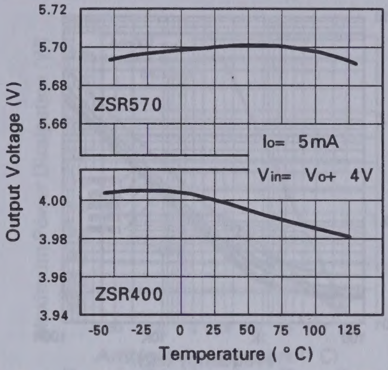
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		8.775	9.0	9.225	V
		I_O=1 to 200mA τ	8.64		9.36	V
		V_{in}=11 to 20V I_O=1 to 100mA τ	8.64		9.36	V
ΔV_O	Line Regulation	V_{in}=11 to 20V		12	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		9 3	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=11 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		150		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=12 to 18V f=120Hz	43	57		dB
V_{in}	Input Voltage Required To Maintain Regulation		11	10.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.25		mV/°C

τ =T_j = -55 to 125°C

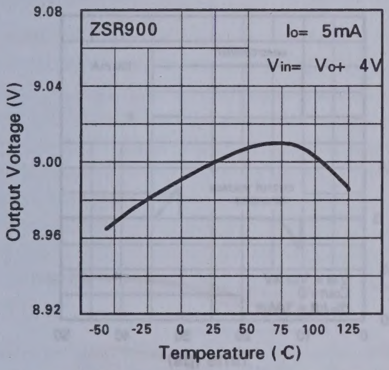
TYPICAL CHARACTERISTICS



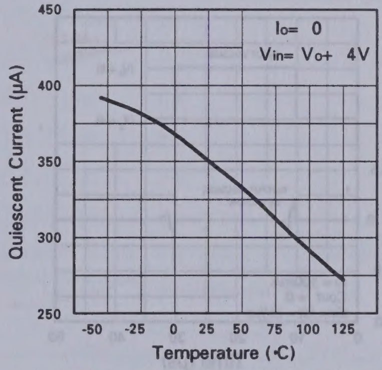
Output Voltage Temperature Coefficient



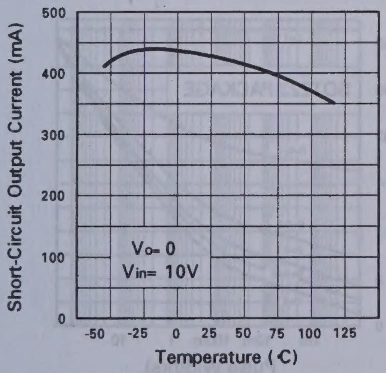
Output Voltage Temperature Coefficient



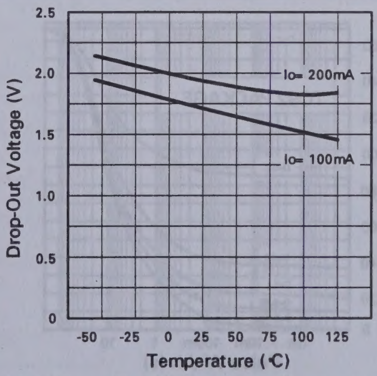
Output Voltage Temperature Coefficient



Quiescent Current vs. Temperature

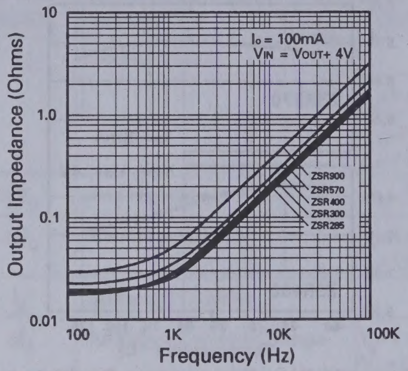


Peak Output Current vs. Temperature

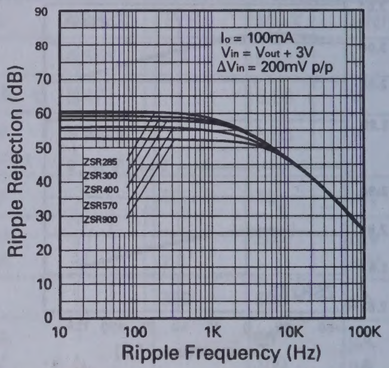


Drop-Out Voltage vs. Temperature

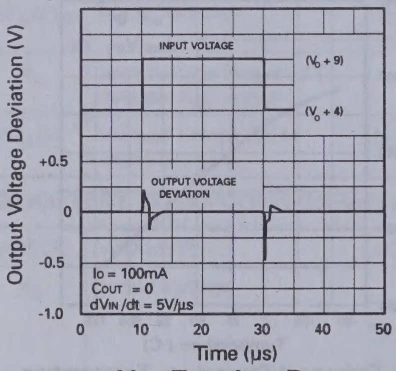
TYPICAL CHARACTERISTICS



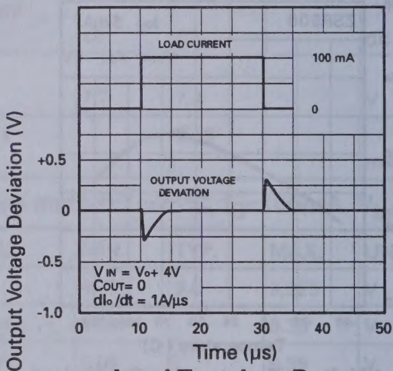
Output Impedance vs. Frequency



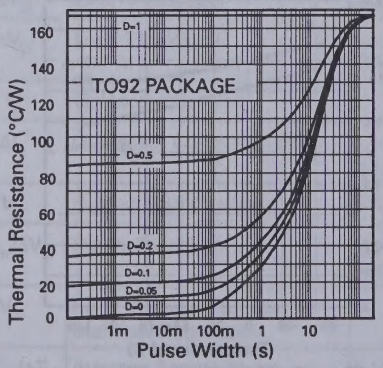
Ripple Rejection vs. Ripple Frequency



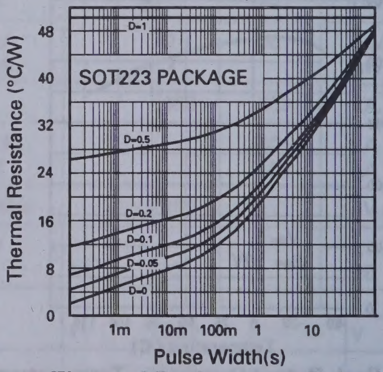
Line Transient Response



Load Transient Response

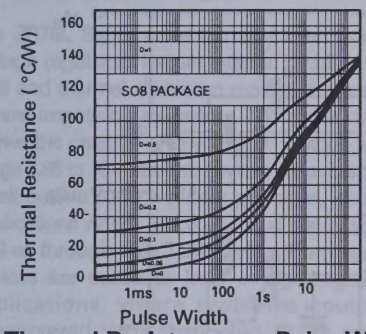


Thermal Resistance v Pulse Width

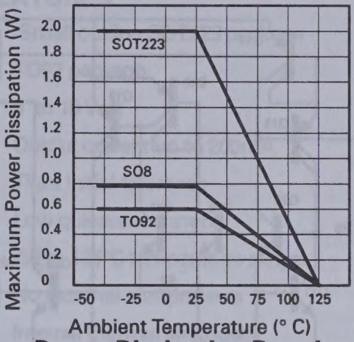


Thermal Resistance v Pulse Width

TYPICAL CHARACTERISTICS



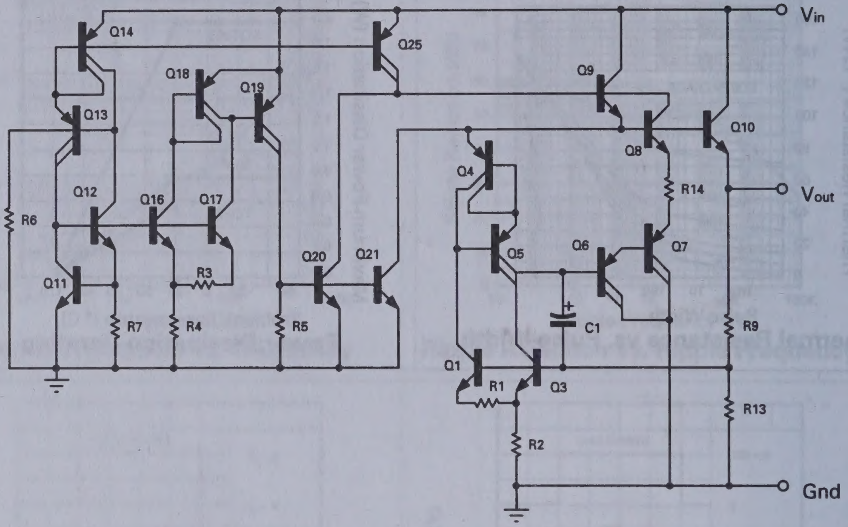
Thermal Resistance vs. Pulse Width



Power Dissipation Derating

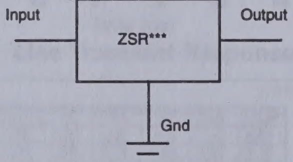
ZSR SERIES

SCHEMATIC DIAGRAM

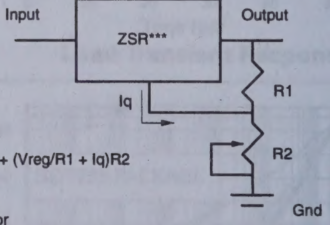

Vin
Q14
Q25
Q18
Q19
Q9
Q13
Q8
Q10
Q4
R14
Vout
Q12
Q16
Q17
R6
Q20
Q21
Q5
Q6
Q7
R3
Q11
C1
R7
R4
R5
R9
Q1
R1
Q3
R13
R2
Gnd

APPLICATIONS

Fixed Output Regulator

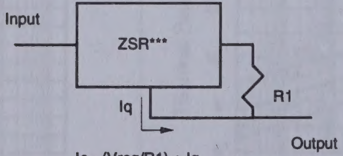

Input
Output
ZSR***
Gnd

Adjustable Output Regulator


Input
Output
ZSR***
Iq
R1
R2
Gnd

Vo= Vreg + (Vreg/R1 + Iq)R2

Current Regulator


Input
ZSR***
Iq
R1
Output

Io= (Vreg/R1) + Iq

2.85 TO 10 VOLT FIXED POSITIVE LOCAL VOLTAGE REGULATOR

ZR78L SERIES

ISSUE 1 - OCTOBER 1995

DEVICE DESCRIPTION

The ZR78L Series three terminal fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices almost impossible to destroy. The circuit design allows the creation of any custom voltage in the range 2.85 to 10 volts. The devices are available in small outline surface mount packages, ideal for applications where space saving is important, as well as through hole TO92 style packaging. The devices are suited to local voltage regulation applications, where problems could be encountered with distributed single source regulation, as well as more general voltage regulation applications.

The ZR78L Series show performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Output voltage change, with input voltage and load current, is much lower than competitive devices. The ZR78L devices are completely stable with no external components. The device will shut down under thermal overload conditions but as the device cools, regulation will restart.

FEATURES

- Small outline SOT223 package
- TO92 package
- 3 to 10 Volt
- Output current up to 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125°C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit

VOLTAGE RANGE

ZR78L033	3.3V
ZR78L05	5V
ZR78L06	6V
ZR78L08	8V
ZR78L10	10V

Contact Zetex Marketing for availability of other voltages

CONNECTION TABLE

Pin	SOT223	TO92
1	OUT	IN
2	G_{nd}	G_{nd}
3	IN	OUT
4	-	–
Pack	G	C

see Diagrams Page 2 - 5

ZR78L SERIES

ABSOLUTE MAXIMUM RATING

Input voltage	20V
Output Current(I_o)	200mA
Operating Temperature	-55 to 125°C
Storage Temperature	-65 to 150°C

ELECTRICAL CHARACTERISTICS:
Notes:

1. The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at 25 °C and must be linearly derated to zero at T_{amb}=125°C.

2. The following data represents pulse test conditions with junction temperatures as indicated at the initiation of the test. Continuous operation of the devices with the stated conditions might exceed the power dissipation limits of the chosen package.

Power Dissipation (T_{amb}=25°C)

SOT223	2W(Note 3)
TO92	600mW

For Power Dissipation Derating graph see ZSR Series datasheet.

3. Maximum power dissipation, for the SOT223 package, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.

4. The shut down feature of the device operates if its temperature exceeds its design limit as might occur during external faults, short circuits etc. If the regulator is supplied from an inductive source then a large voltage transient, on the regulator input, can result should the shut down circuit operate. It is advised that a capacitor (1μF or greater) should be applied across the regulator input to ensure that the maximum voltage rating of the device is not exceeded under shutdown conditions.

ZR78L033
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=7.3V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		3.218	3.3	3.382	V
		I_O=1 to 200mA τ	3.168		3.432	V
		V_{in}=5.3 to 20V I_O=1 to 100mA τ	3.168		3.432	V
ΔV_O	Line Regulation	V_{in}=5.3 to 20V		7.5	30	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=5.3 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		50		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=6.3 to 18V f=120Hz	50	64		dB
V_{in}	Input Voltage Required To Maintain Regulation		5.3	5		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ =T_j = -55 to 125 °C

ZR78L05
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=9V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		4.875	5	5.125	V
		I_O=1 to 200mA τ	4.8		5.2	V
		V_{in}=7 to 20V I_O=1 to 100mA τ	4.8		5.2	V
ΔV_O	Line Regulation	V_{in}=7 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		7	6.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

ZR78L06
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=10V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		5.85	6	6.15	V
		I_O=1 to 200mA τ	5.76		6.24	V
		V_{in}=8 to 20V I_O=1 to 100mA τ	5.76		6.24	V
ΔV_O	Line Regulation	V_{in}=8 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		7 2.5	30	mV mV
I_q	Quiescent Current	τ		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=8 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		90		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=9 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		8	7.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.15		mV/°C

τ =T_j = -55 to 125 °C

ZR78L08
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=12V

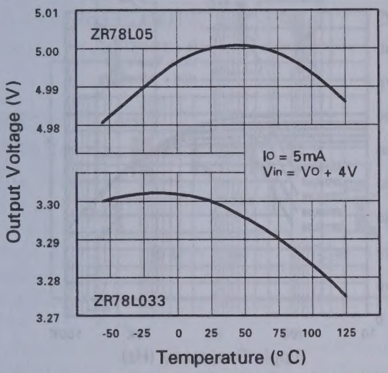
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		7.8	8	8.2	V
		I_O=1 to 200mA τ	7.68		8.32	V
		V_{in}=10 to 20V I_O=1 to 100mA τ	7.68		8.32	V
ΔV_O	Line Regulation	V_{in}=10 to 20V		11	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		8 3	30	mV mV
I_q	Quiescent Current	τ		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=10 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		115		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=11 to 18V f=120Hz	44	60		dB
V_{in}	Input Voltage Required To Maintain Regulation		10	9.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.25		mV/°C

ZR78L10
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=14V

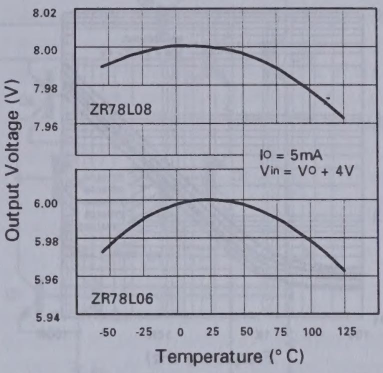
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		9.75	10	10.25	V
		I_O=1 to 200mA τ	9.6		10.4	V
		V_{in}=12 to 20V I_O=1 to 100mA τ	9.6		10.4	V
ΔV_O	Line Regulation	V_{in}=12 to 20V		12	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		9 3	30	mV mV
I_q	Quiescent Current	τ		350	600	μA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=12 to 20V			50 100	μA μA
V_n	Output Noise Voltage	f=10Hz to 10KHz		150		μV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=13 to 18V f=120Hz	43	57		dB
V_{in}	Input Voltage Required To Maintain Regulation		12	11.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.25		mV/°C

τ =T_j = -55 to 125 °C

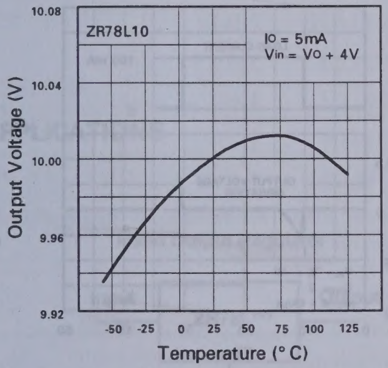
TYPICAL CHARACTERISTICS



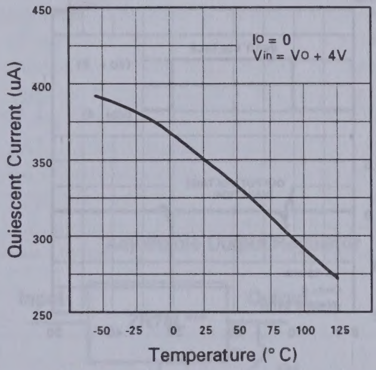
Output Voltage Temperature Coefficient



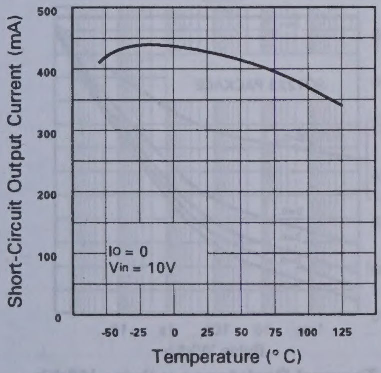
Output Voltage Temperature Coefficient



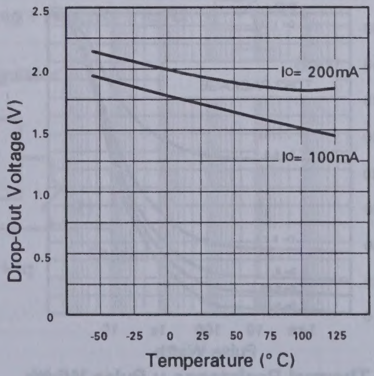
Output Voltage Temperature Coefficient



Quiescent Current v Temperature

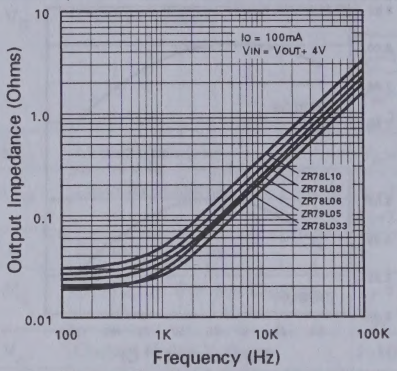


Peak Output Current v Temperature

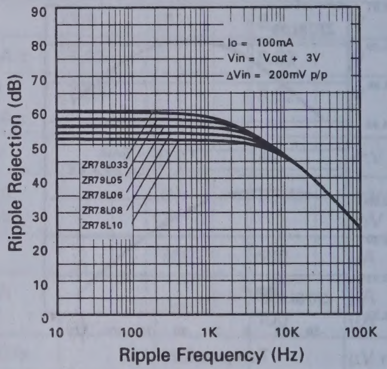


Drop-Out Voltage v Temperature

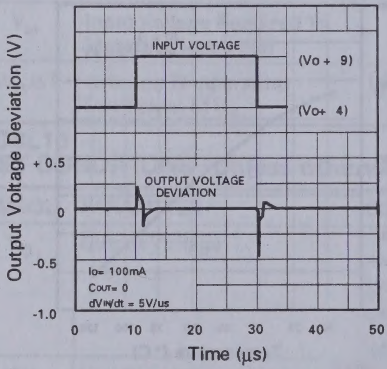
TYPICAL CHARACTERISTICS



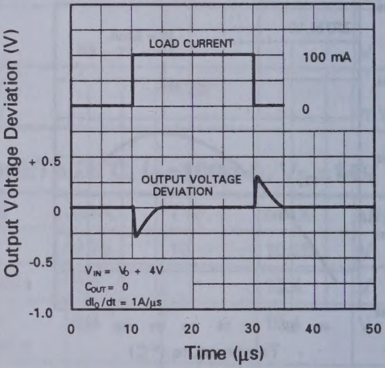
Output Impedance v Frequency



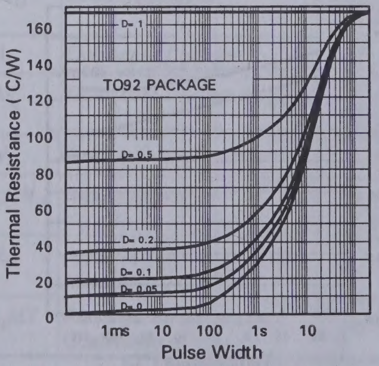
Ripple Rejection v Ripple Frequency



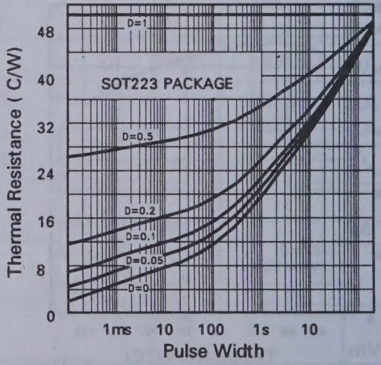
Line Transient Response



Load Transient Response

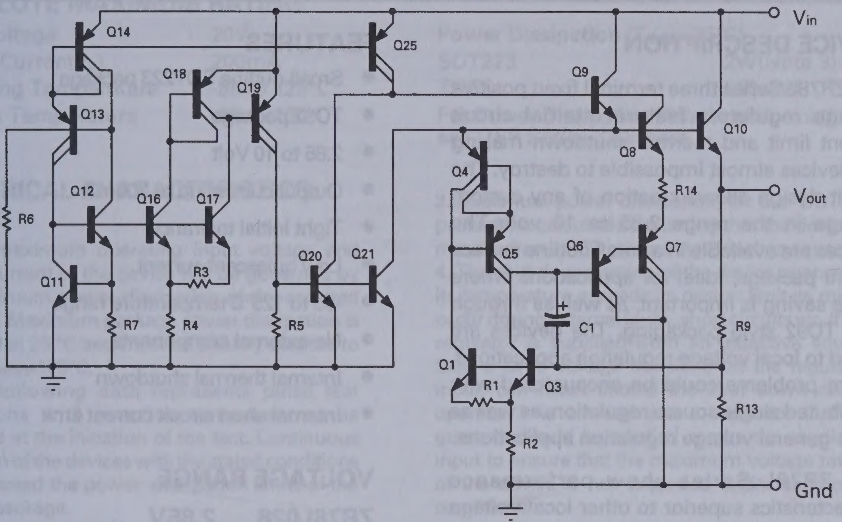


Thermal Resistance v Pulse Width



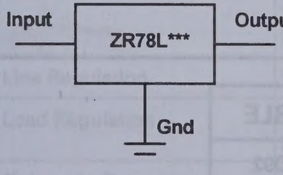
Thermal Resistance v Pulse Width

SCHEMATIC DIAGRAM

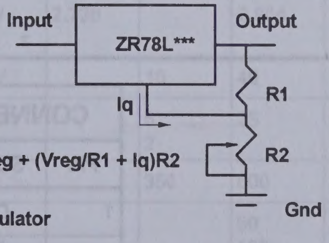

Q14
Q25
Vin
Q18
Q19
Q13
Q9
Q10
Q8
Q4
R14
Vout
Q12
Q16
Q17
R6
Q6
Q7
Q20
Q21
Q5
R3
Q11
R7
R4
R5
C1
R9
Q1
R1
Q3
R13
R2
Gnd

APPLICATIONS

Fixed Output Regulator

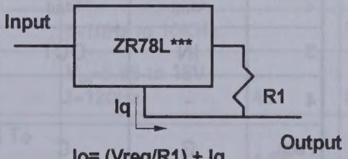

Input
ZR78L***
Output
Gnd

Adjustable Output Regulator


Input
ZR78L***
Output
Iq
R1
R2
Gnd

Vo= Vreg + (Vreg/R1 + Iq)R2

Current Regulator


Input
ZR78L***
Iq
R1
Output

Io= (Vreg/R1) + Iq

2.85 TO 10 VOLT FIXED POSITIVE LOCAL VOLTAGE REGULATOR

ISSUE 1 - DECEMBER 1995

ZR78L SERIES

DEVICE DESCRIPTION

The ZR78L Series three terminal fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices almost impossible to destroy. The circuit design allows creation of any custom voltage in the range 2.85 to 10 volts.The devices are available in a small outline surface mount package, ideal for applications where space saving is important, as well as through hole TO92 style packaging. The devices are suited to local voltage regulation applications, where problems could be encountered with distributed single source regulation, as well as more general voltage regulation applications.

The ZR78L Series show performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Output voltage change, with input voltage and load current, is much lower than competitive devices. The ZR78L devices are completely stable with no external components. The device will shut down under thermal overload conditions but as the device cools, regulation will restart.

FEATURES

- Small outline SOT223 package
- TO92 package
- 2.85 to 10 Volt
- Output current up to 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125°C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit

VOLTAGE RANGE

ZR78L028	**2.85V**
ZR78L03	**3.0V**
ZR78L04	**4.0V**
ZR78L057	**5.7V**
ZR78L09	**9.0V**

Contact Zetex Marketing for availability of other voltages

CONNECTION TABLE

Pin	SOT223	TO92
1	OUT	IN
2	G_{nd}	G_{nd}
3	IN	OUT
4	-	–
Pack	G	C

see Diagrams Page 2 - 5

ABSOLUTE MAXIMUM RATING

Input voltage	20V
Output Current(I_O)	200mA
Operating Temperature	-55 to 125°C
Storage Temperature	-65 to 150°C

Power Dissipation (T_{amb}=25°C)

SOT223	2W(Note 3)
TO92	600mW

For Power Dissipation Derating Information see ZSR Series datasheet.

ELECTRICAL CHARACTERISTICS:
Notes:

1. The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at 25 °C and must be linearly derated to zero at T_{amb}=125°C.

2. The following data represents pulse test conditions with junction temperatures as indicated at the initiation of the test. Continuous operation of the devices with the stated conditions might exceed the power dissipation limits of the chosen package.

3. Maximum power dissipation, for the SOT223 package, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.

4. The shut down feature of the device operates if its temperature exceeds its design limit as might occur during external faults, short circuits etc. If the regulator is supplied from an inductive source then a large voltage transient, on the regulator input, can result should the shut down circuit operate. It is advised that a capacitor (1µF or greater) should be applied across the regulator input to ensure that the maximum voltage rating of the device is not exceeded under shutdown conditions.

ZR78L028
TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=6.85V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		2.78	2.85	2.92	V
		I_O=1 to 200mA τ	2.736		2.964	V
		V_{in}=4.85 to 20V I_O=1 to 100mA τ	2.736		2.964	V
ΔV_O	Line Regulation	V_{in}=4.85 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=4.85 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=5.85 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		4.85	4.55		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ=T_j=-55 to 125°C

ZR78L03 TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=7V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		2.92	3.0	3.08	V
		I_O=1 to 200mA τ	2.88		3.12	V
		V_{in}=5 to 20V I_O=1 to 100mA τ	2.88		3.12	V
ΔV_O	Line Regulation	V_{in}=5 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=5 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=6 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		5	4.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

ZR78L04 TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=8V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		3.9	4.0	4.1	V
		I_O=1 to 200mA τ	3.84		4.16	V
		V_{in}=6 to 20V I_O=1 to 100mA τ	3.84		4.16	V
ΔV_O	Line Regulation	V_{in}=6 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=6 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=7 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		6	5.3		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.1		mV/°C

τ =T_j = -55 to 125°C

ZR78L057 TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=9.7V

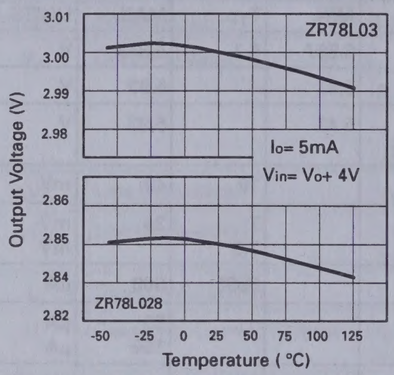
SYMBOL	PARAMETER	CONDITIONS	MIN.	Typ.	MAX.	UNITS
V_O	Output Voltage		5.557	5.7	5.843	V
		I_O=1 to 200mA τ	5.47		5.93	V
		V_{in}=7.7 to 20V I_O=1 to 100mA τ	5.47		5.93	V
ΔV_O	Line Regulation	V_{in}=7.7 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		7 2.5	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7.7 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		90		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8.7 to 18V f=120Hz	48	62		dB
V_{in}	Input Voltage Required To Maintain Regulation		7.7	7.4		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.15		mV/°C

ZR78L09TEST CONDITIONS (Unless otherwise stated):T_j=25°C, I_O=100mA, V_{in}=13V

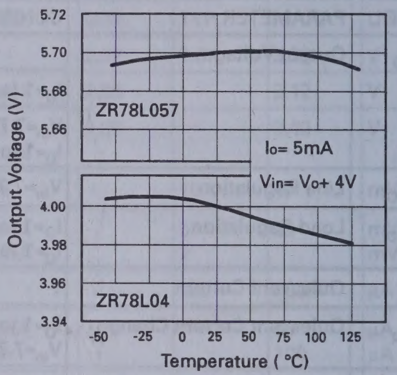
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		8.775	9.0	9.225	V
		I_O=1 to 200mA τ	8.64		9.36	V
		V_{in}=11 to 20V I_O=1 to 100mA τ	8.64		9.36	V
ΔV_O	Line Regulation	V_{in}=11 to 20V		12	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		9 3	30	mV mV
I_q	Quiescent Current	τ		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=11 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		150		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=12 to 18V f=120Hz	43	57		dB
V_{in}	Input Voltage Required To Maintain Regulation		11	10.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA τ		0.25		mV/°C

τ =T_j = -55 to 125°C

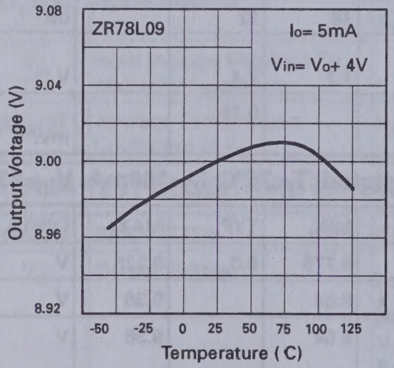
TYPICAL CHARACTERISTICS



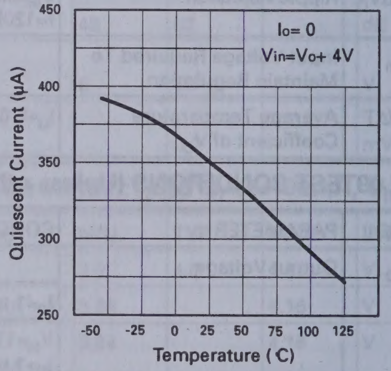
Output Voltage Temperature Coefficient



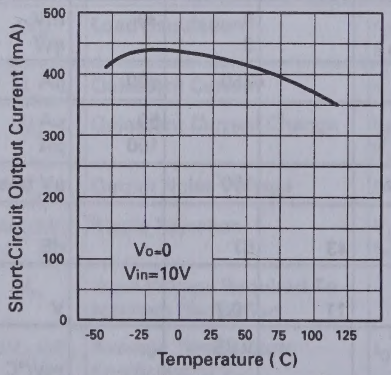
Output Voltage Temperature Coefficient



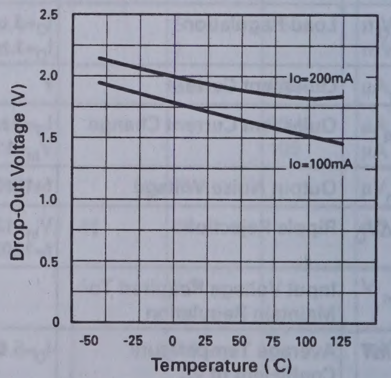
Output Voltage Temperature Coefficient



Quiescent Current vs. Temperature

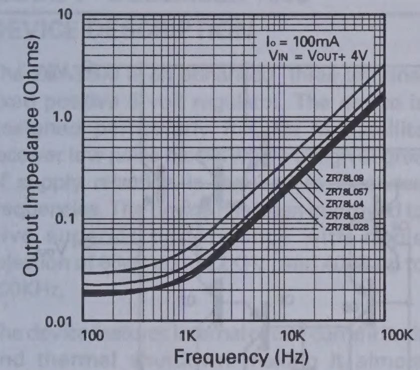


Peak Output Current vs. Temperature

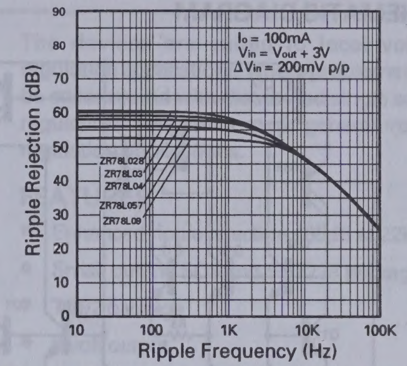


Drop-Out Voltage vs. Temperature

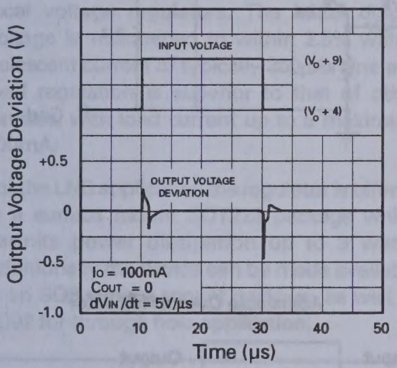
TYPICAL CHARACTERISTICS



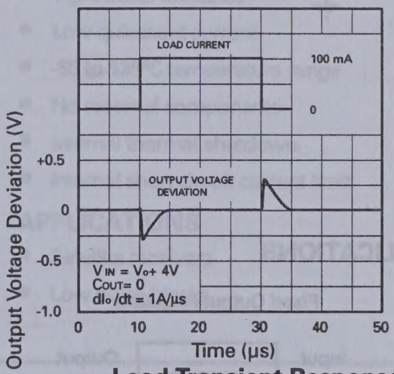
Output Impedance vs. Frequency



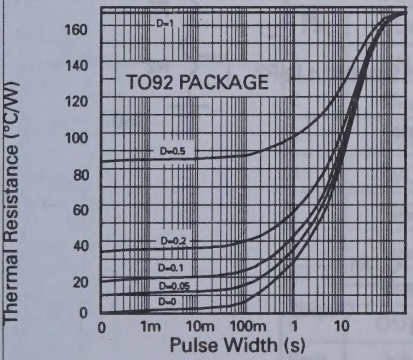
Ripple Rejection vs. Ripple Frequency



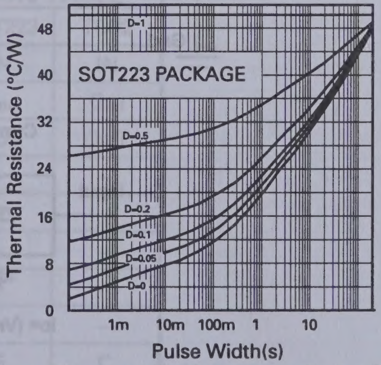
Line Transient Response



Load Transient Response



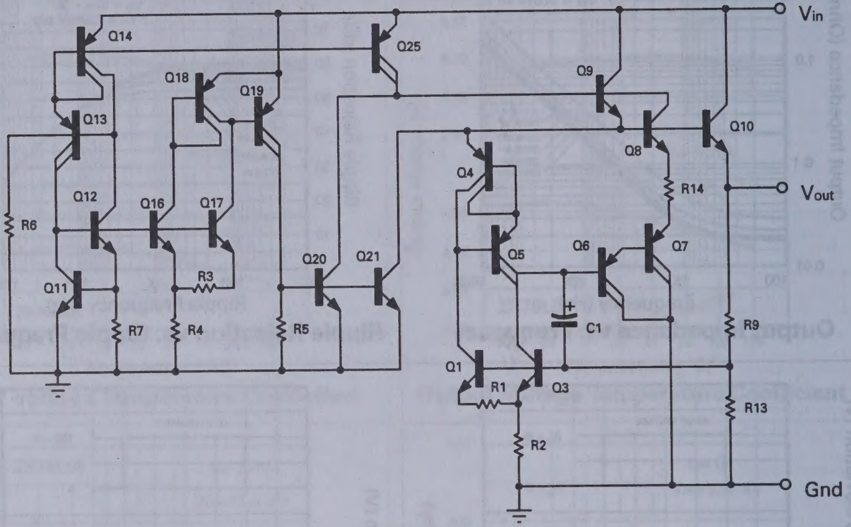
Thermal Resistance v Pulse Width



Thermal Resistance v Pulse Width

ZR78L SERIES

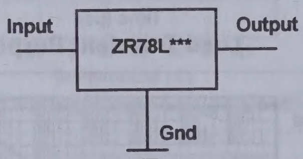
SCHEMATIC DIAGRAM



Vin
Q14
Q25
Q18
Q19
Q9
Q13
Q8
Q10
Q4
R14
Vout
R6
Q12
Q16
Q17
Q5
Q6
Q7
Q11
R3
Q20
Q21
R7
R4
R5
C1
R9
Q1
R1
Q3
R13
R2
Gnd

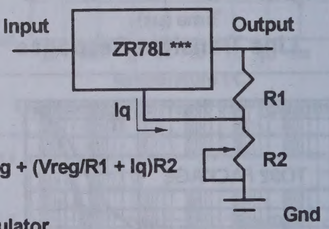
APPLICATIONS

Fixed Output Regulator



Input
Output
ZR78L***
Gnd

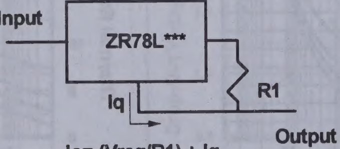
Adjustable Output Regulator



Input
Output
ZR78L***
Iq
R1
R2
Gnd

Vo= Vreg + (Vreg/R1 + Iq)R2

Current Regulator



Input
ZR78L***
Iq
R1
Output

Io= (Vreg/R1) + Iq

5 VOLT ENHANCED POSITIVE LOCAL VOLTAGE REGULATOR

ZSAT500

ISSUE 1 - DECEMBER 1995

DEVICE DESCRIPTION

The ZSAT500 is an enhanced three terminal fixed positive 5 volt regulator. The device is designed particularly for use in Satellite receiver low noise blocks where a high degree of supply rejection is required to extended frequencies. The device has been improved to give superior performance with ripple rejection of 65dB up to 22KHz , and 40dB up to 200KHz.

The device features internal circuit current limit and thermal shutdown making it almost impossible to destroy. The ZSAT500 shows performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Line and load regulation is superior to that of other devices, with load current up to a maximum 200mA.

For the LNB application the regulator is offered in a surface mount SOT223 package which permits power dissipation up to 3 watts. Additionally the device can be made available in an SO8 surface mount package, as well as TO92 for through hole application.

The devices are suited to local voltage regulation applications, where problems could be encountered with distributed single source regulation, as well as more general voltage regulation applications.

FEATURES

- Enhanced ripple rejection - 65dB at 22kHz
- Small outline SO8 and SOT223 packages
- TO92 package
- 5 volt output
- Output current upto 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125°C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit

APPLICATIONS

- Satellite receivers
- Low noise blocks

CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	IN	IN	IN
2	G_{nd}	G_{nd}	G_{nd}
3	G_{nd}	OUT	OUT
4	N/C	-	–
5	N/C	–	–
6	G_{nd}	–	–
7	G_{nd}	–	–
8	OUT	–	–
Pack	N8	G	C

see Diagrams Page 2 - 5

ZSAT500

ABSOLUTE MAXIMUM RATING

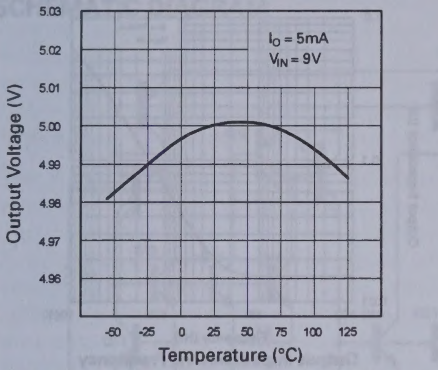
Input voltage	20V
Output Current(I_O)	200mA
Operating Temperature	-55 to 125°C
Storage Temperature	-65 to 150°C

Power Dissipation (T_{amb}=25°C)	
SOT223	3W(Note 3)
TO92	600mW
SO8	780mW(Note 3)

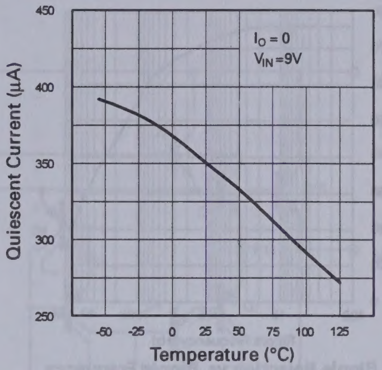
ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated): T_j=25°C, I_O=100mA, V_{in}=9V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
V_O	Output Voltage		4.875	5	5.125	V
		I_O=1 to 200mA T_j=-55 to 125°C	4.8		5.2	V
		V_{in}=7 to 20V I_O=1 to 100mA T_j=-55 to 125°C	4.8		5.2	V
ΔV_O	Line Regulation	V_{in}=7 to 20V		10	40	mV
ΔV_O	Load Regulation	I_O=1 to 200mA I_O=1 to 100mA		5 2	25	mV mV
I_q	Quiescent Current	T_j=-55 to 125°C		350	600	µA
ΔI_q	Quiescent Current Change	I_O=1 to 200mA V_{in}=7 to 20V			50 100	µA µA
V_n	Output Noise Voltage	f=10Hz to 10KHz		75		µV rms
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8 to 18V f=120Hz-22KHz	65			dB
$\Delta V_{in}/\Delta V_O$	Ripple Rejection	V_{in}=8 to 18V f=200KHz	40			dB
V_{in}	Input Voltage Required To Maintain Regulation		7	6.7		V
$\Delta V_O/\Delta T$	Average Temperature Coefficient of V_O	I_O=5.0mA T_j=-55 to 125°C		0.1		mV/°C
V_{GI}	Reverse Supply Protection Diode Forward Voltage	I_{GI}=500mA			2	V

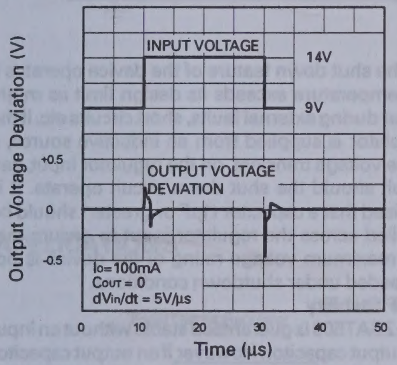
TYPICAL CHARACTERISTICS



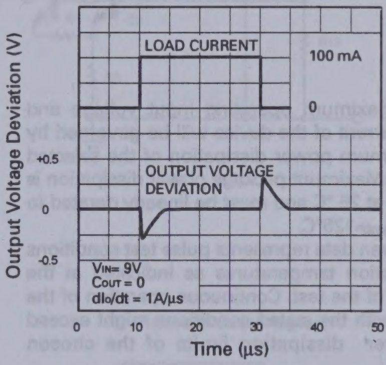
Output Voltage Temperature Coefficient



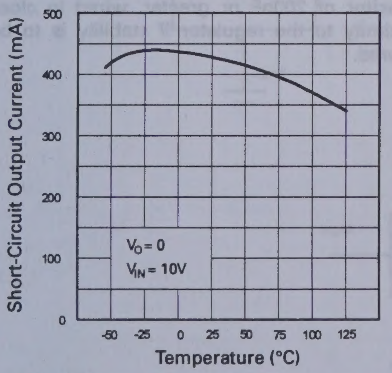
Quiescent Current v Temperature



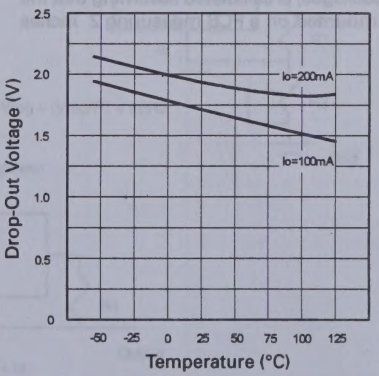
Line Transient Response



Load Transient Response

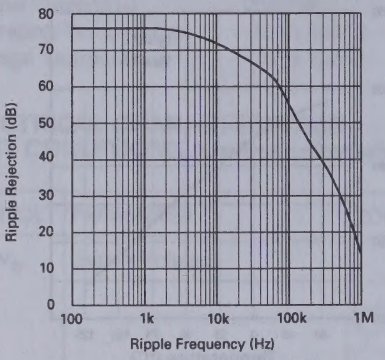


Peak Output Current v Temperature

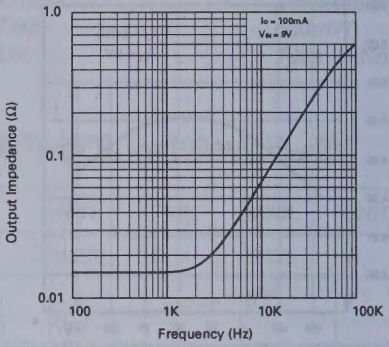


Drop-Out Voltage v Temperature

TYPICAL CHARACTERISTICS



Ripple Rejection vs. Ripple Frequency



Output Impedance vs. Frequency

Notes:

1. The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at 25 °C and must be linearly derated to zero at T_{amb}=125°C.

2. The given data represents pulse test conditions with junction temperatures as indicated at the initiation of the test. Continuous operation of the devices with the stated conditions might exceed the power dissipation limits of the chosen package.

3. Maximum power dissipation, for the SO8 and SOT223 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.

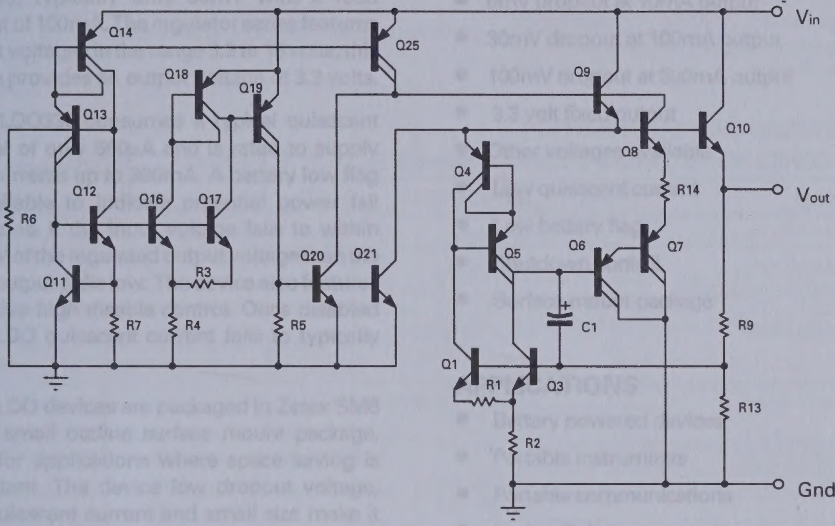
4. The shut down feature of the device operates if its temperature exceeds its design limit as might occur during external faults, short circuits etc. If the regulator is supplied from an inductive source, a large voltage transient, on the regulator input, can result should the shut down circuit operate. It is advised that a capacitor (1µF or greater) should be applied across the regulator input to ensure that the maximum voltage rating of the device is not exceeded under shutdown conditions.

5. HF Stability

The ZSAT500 is guaranteed stable without an input or output capacitor. However if an output capacitor is used then this should be a total value of at least 100nF and should be accompanied by an input capacitor of 200nF or greater, wired in close proximity to the regulator if stability is to be ensured.

ZSAT500

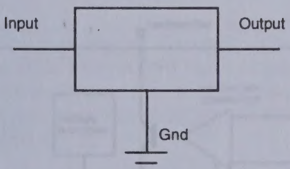
SCHEMATIC DIAGRAM



Q14
Q25
Q18
Q19
Q13
Q9
Q8
Q10
Q4
R14
Vin
Vout
Q12
Q16
Q17
R6
Q6
Q7
Q5
Q20
Q21
R3
Q11
R7
R4
R5
C1
R9
Q1
R1
Q3
R13
R2
Gnd

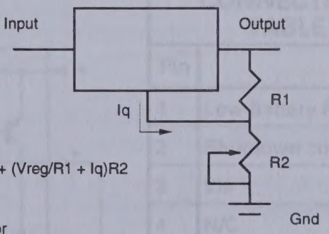
APPLICATIONS

Fixed Output Regulator



Input
Output
Gnd

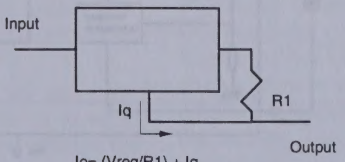
Adjustable Output Regulator



Input
Output
Iq
R1
R2
Gnd

$$V_o = V_{reg} + (V_{reg}/R1 + I_q)R2$$

Current Regulator



Input
Iq
R1
Output

$$I_o = (V_{reg}/R1) + I_q$$

3.3 VOLT ULTRA LOW DROPOUT REGULATOR

ZLDO330

ISSUE 1 - DECEMBER 1995

The ZLDO Series low dropout linear regulators operate with an exceptionally low dropout voltage, typically only 30mV with a load current of 100mA. The regulator series features output voltages in the range 3.3 to 18 volts, this device provides an output voltage of 3.3 volts.

The ZLDO330 consumes a typical quiescent current of only 560µA and is rated to supply load currents up to 300mA. A battery low flag is available to indicate potential power fail situations. If the input voltage falls to within 300mV of the regulated output voltage then the error output pulls low. The device also features an active high disable control. Once disabled the ZLDO quiescent current falls to typically 11µA.

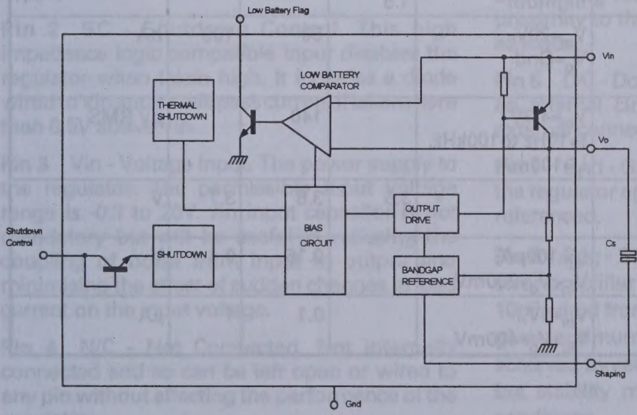
The ZLDO devices are packaged in Zetex SM8 8 pin small outline surface mount package, ideal for applications where space saving is important. The device low dropout voltage, low quiescent current and small size make it ideal for low power and battery powered applications. Battery powered circuits can make particular use of the low battery flag and shutdown features.

FEATURES

- Very low dropout voltage
- 6mV dropout at 10mA output
- 30mV dropout at 100mA output
- 100mV dropout at 300mA output
- 3.3 volt fixed output
- Other voltages available
- Low quiescent current
- Low battery flag
- Shutdown control
- Surface mount package

APPLICATIONS

- Battery powered devices
- Portable instruments
- Portable communications
- Laptop/Palmtop computers
- Electronic organisers



CONNECTION TABLE

Pin	
1	Low Battery Flag
2	Shutdown control
3	Vin
4	N/C
5	Vout
6	**Do not Connect**
7	Gnd
8	Shaping
Pack	T8

see Diagrams Page 2 - 5

ZLDO330

ABSOLUTE MAXIMUM RATING

Input Supply Voltage Range	-0.3 to 20V	Output Current	300mA
Shutdown Input Voltage Range	-0.3 to Vin	Operating Temperature	-40 to 85°C
Low Battery Output Voltage Range	-0.3 to 20V	Storage Temperature	-55 to 150°C
		Power Dissipation (Tamb=25°C)	2W (Note 1)

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS (Unless otherwise stated) T_{amb}=25°C,I_L=10mA,C_s=10pF,C_{out}=1µF

Parameter	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output voltage	V_o	V_{in}=4.3V	3.2	3.3	3.4	V
Output voltage temperature coefficient	$\frac{V_o}{\Delta T}$	V_{in}=4.3V (Note 2, Note 4)		100	2 50	ppm/ °C
Line regulation	$\frac{V_{in}}{\Delta V_o}$	V_{in}=4.3 to 20V		3.3		mV/ V
Load regulation	ΔV_o	I_L=10 to 300mA V_{in}=4.3V		66		mV
Dropout voltage (Note3)	V_{in}-V_o	I_L=10mA I_L=100mA I_L=300mA		6 30 100	10 75 200	mV
Quiescent current	I_q	V_{in}=4.3V, I_L=0		0.56	1	mA
Quiescent current at shutdown	I_{qs}	V_{in}=4.3V, I_L=0, V_{shdn}=V_{in}		11	30	µA
Shutdown control input current	I_{ins}	V_{shdn}=V_{in}=4.3V		2	10	µA
Shutdown control threshold voltage	V_{ts}	V_{in}=4.3V low(on) high(off)	 1.5		 0.4	V
Output current in shutdown mode (Note4)	I_{Ls}	V_{in}=20V V_o=Gnd		50	100	nA
Output noise voltage (Note4)	e_n	V_{in}=4.3V f=10Hz to100kHz, I_L=100mA		140		µV RMS
Low battery detect voltage	$V_{in(bld)}$		3.5	3.6	3.7	V
Low battery flag output voltage	V_{bl}	I_{bl}=100µA, V_{in}<V_o+200mV		0.16	0.4	V
Low battery flag leakage current	I_{bl}	V_{bl}=6V, V_{in}>V_o+400mV		0.1	1	µA

NOTES.

1. Maximum power dissipation of the device is calculated assuming the package is mounted on a PCB measuring 2 inches square.

2 Output voltage temperature coefficient is calculated as:- $\dfrac{V_O \textit{ change} \times 1000000}{V_O \times \textit{temperature change}}$

3. Dropout voltage (See Definition of Terms (below))

4. Guaranteed by design.

DEFINITION OF TERMS

Dropout Voltage: The minimum input to output voltage differential for which the circuit will continue to regulate. The value is measured when the output voltage has dropped by 100mV from the nominal value obtained at Vin=6V.

Input Voltage: The DC voltage applied to the device input terminal with respect to ground.

Input To Output Voltage Differential: The difference between the applied unregulated input voltage and the regulated output voltage.

Line Regulation: The change in output voltage for a given change in input voltage.

Load Regulation: The change in output voltage for a given change in load current.

Output Noise Voltage: The R.M.S. AC output voltage measured over a defined frequency range, at constant load current and no input ripple.

Quiescent Current: The device input current minus the load current.

Output Voltage Temperature Coefficient: The change in output voltage with temperature over the operating temperature range of the device.

PIN DEFINITIONS

Pin 1 LBF - Low Battery Flag. An open collector NPN output which pulls low on failing input supply.

Pin 2 SC - Shutdown Control. This high impedance logic compatible input disables the regulator when taken high. It includes a diode wired to Vin and so will pass current if taken more than 0.5V above Vin.

Pin 3 Vin - Voltage Input. The power supply to the regulator. The permissible input voltage range is -0.3 to 20V. An input capacitor is not mandatory but will be useful in reducing the coupling of noise from input to output and minimising the effect of sudden changes in load current on the input voltage.

Pin 4 N/C - Not Connected. Not internally connected and so can be left open or wired to any pin without affecting the performance of the regulator.

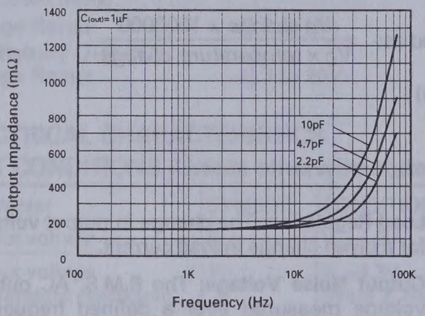
Pin 5 Vout - Voltage Output. The output of the regulator. An output capacitor of 1uF or greater and having low ESR should be wired in close proximity to the regulator to ensure stability for all loads.

Pin 6 D/C - Do Not Connect. This pin is wired to an internal circuit node of the regulator. No external connection should be made to this pin.

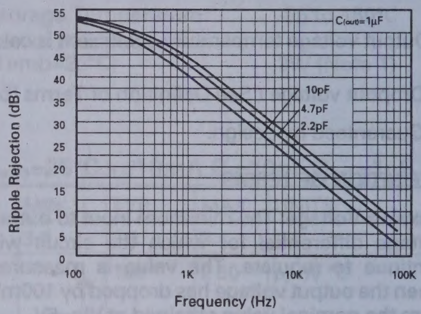
Pin 7 Gnd - Ground. The ground connection of the regulator against which the output voltage is referenced.

Pin 8 Spg - Shaping. The shaping node for the error amplifier of the regulator. A capacitor of 10pF wired from this pin to the output pin (pin 5) gives optimum stability. Improved AC can be achieved by reducing the value of this capacitor but stability may be impaired for some load conditions.

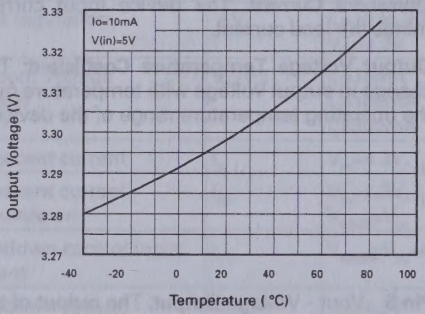
TYPICAL CHARACTERISTICS



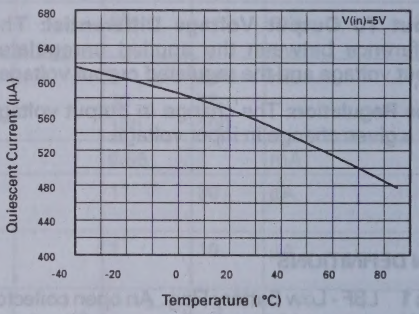
Output Impedance vs. Frequency



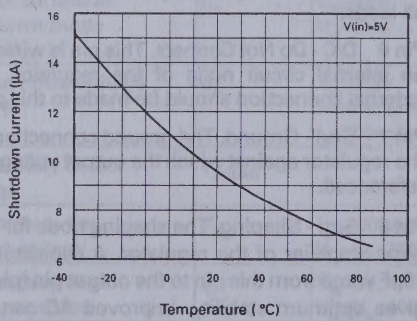
Ripple Rejection vs. Frequency



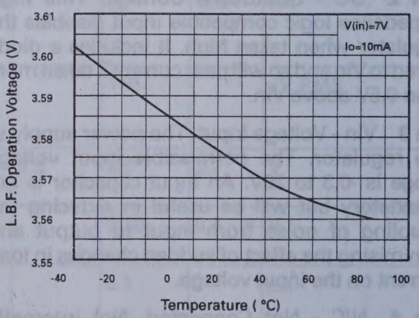
Output Voltage Temperature Coefficient



Quiescent Current vs. Temperature

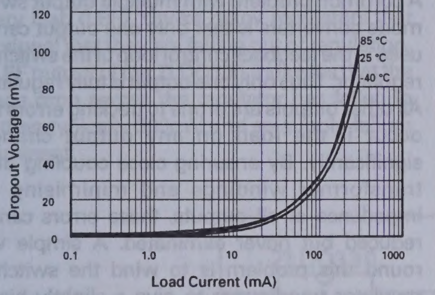


Shutdown Current vs. Temperature

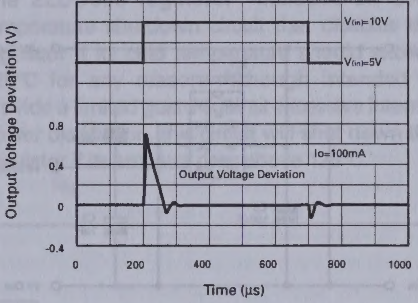


Low Battery Flag Operating Point

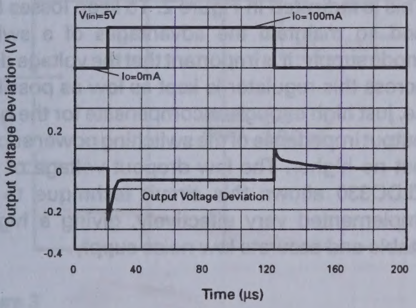
TYPICAL CHARACTERISTICS



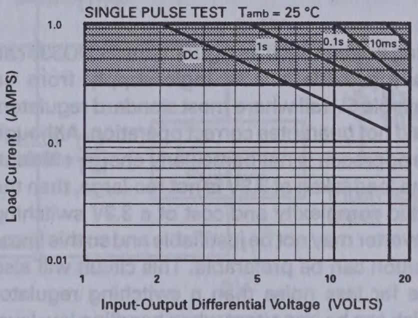
Dropout Voltage vs. Load Current



Line Transient Response



Load Transient Response



Safe Operating Area

Operation in shaded area is not guaranteed

APPLICATIONS

1). Simple 3.3V Supply

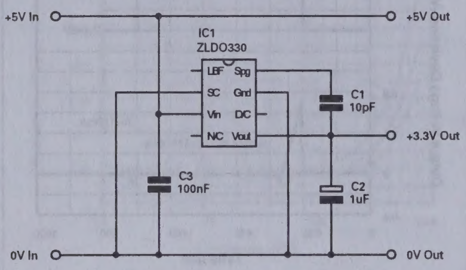

+5V In
+5V Out
IC1
ZLDO330
LBF
Spg
SC
Gnd
Vin
D/C
NC
Vout
C1
10pF
+3.3V Out
C3
100nF
C2
1uF
0V In
0V Out

Figure 1

Using a circuit such as Figure 1, the ZLDO330 can easily provide a 3.3V logic supply from an available 5V rail where most standard regulators could not guarantee correct operation. Although this approach is not particularly energy efficient, if the load taken at 3.3V is not too large, then the added complexity and cost of a 3.3V switching converter may not be justifiable and so this linear solution can be preferable. This circuit will also give far less noise than a switching regulator which can be important when handling low level analogue signals or low voltage measurements.

2). Post Converter Regulation

A common problem with multiple output switch mode converters is that only one output can be used in the feedback control loop of the switching regulator. Thus only one output is fully regulated. All other outputs are prone to tracking errors that occur if the load on any output changes significantly. By ensuring close coupling of all transformer windings and minimising the impedance of all outputs, these errors can be reduced but never eliminated. A simple way round this problem is to wind the switching regulator transformer to give a slightly higher voltage than required and regulate down from this to the desired voltage with a linear regulator. This is indicated in Figure 2. To keep losses low and so maintain the advantages of a switch mode supply, it is important that the voltage drop across this regulator is kept as low as possible, i.e. just high enough to compensate for the poor output impedance of the switching power supply but no higher. The low dropout voltage of the ZLDO330 allows this circuit technique to be implemented very effectively, giving a highly stable and accurate low noise supply.

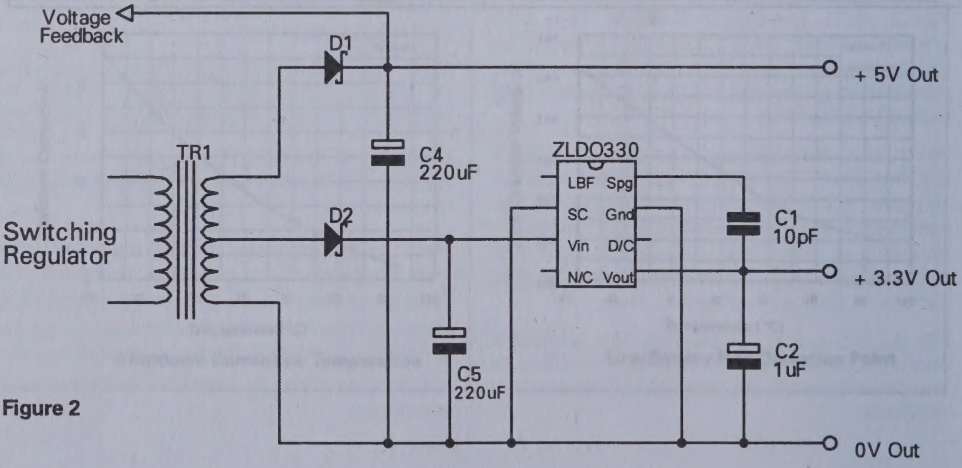

Voltage Feedback
D1
+ 5V Out
TR1
C4
220uF
ZLDO330
LBF
Spg
SC
Gnd
Vin
D/C
N/C
Vout
Switching Regulator
D2
C1
10pF
+ 3.3V Out
C5
220uF
C2
1uF
0V Out

Figure 2

APPLICATIONS

3). Low Battery Flag

The ZLDO330 provides an output called Low Battery Flag (LBF). Unlike many regulators that only signal that they are falling out of regulation, the LBF output of the ZLDO330 indicates that the voltage drop across the regulator has fallen to less than typically 300mV and so supply failure is imminent.

4). Over Temperature Shutdown

The ZLDO330 regulator includes an over temperature shutdown circuit that disables the regulator if its chip temperature should exceed 125°C for any reason. Although intended to provide a limited guard against excessive internal power dissipation, this circuit will shut down the regulator if its ambient rises above 125°C.

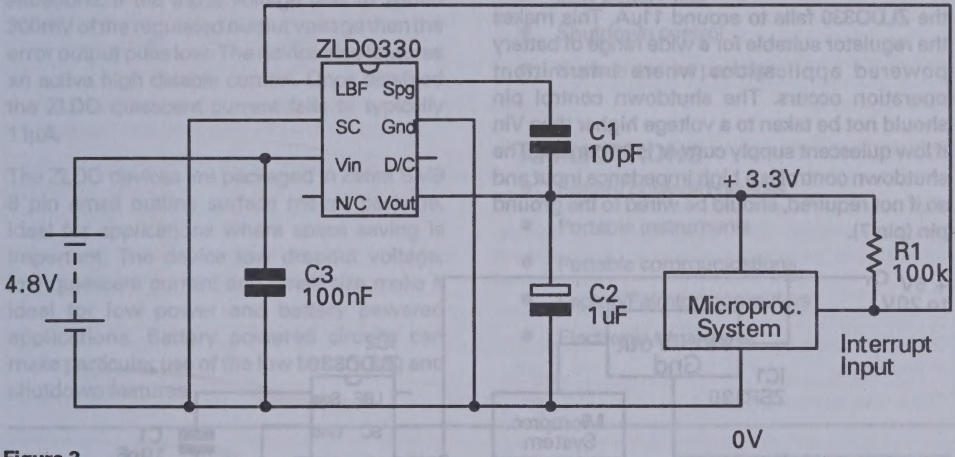


Figure 3

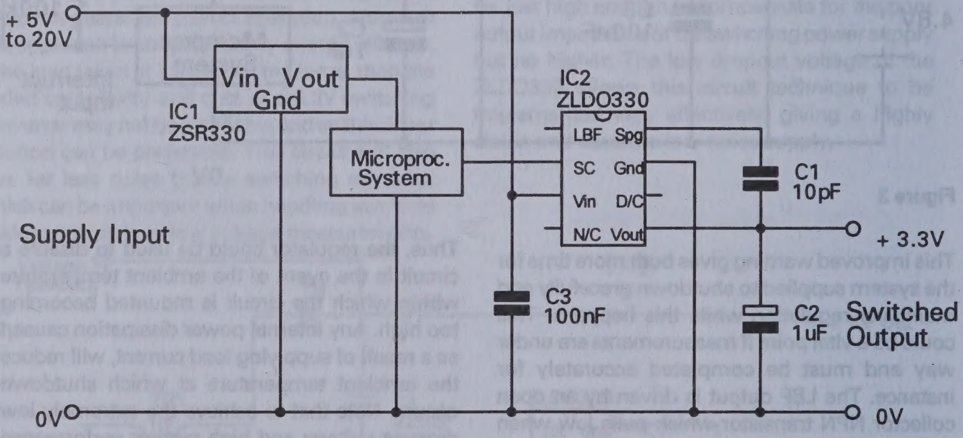
This improved warning gives both more time for the system supplied to shutdown gracefully and maintains regulation while this happens. This could be a vital point if measurements are under way and must be completed accurately for instance. The LBF output is driven by an open collector NPN transistor which pulls low when the supply to the regulator is failing. Figure 3 shows this output being used. Note that resistor R1 is necessary only if the interrupt logic does not include a pull-up resistor.

Thus, the regulator could be used to disable a circuit in the event of the ambient temperature within which the circuit is mounted becoming too high. Any internal power dissipation caused as a result of supplying load current, will reduce the ambient temperature at which shutdown occurs. Note that to achieve the extremely low dropout voltage and high current performance provided by the ZLDO devices, the parts can be damaged by sustained output shorts or excessive loads when combined with high input supply voltages. To ensure reliable operation, keep loads within the SOA graph boundaries indicated in the typical characteristics.

APPLICATIONS

5). Logic Controlled Power Supply

Fig.4 shows all that is necessary to allow a microprocessor to control a power supply based on the ZLDO330. The Shutdown Control pin (pin 2), is a logic compatible input that disables the regulator when a voltage in excess of 1.5V is applied. The current required to drive this input is less than 10uA. When the regulator is shutdown in this way, the quiescent current of the ZLDO330 falls to around 11µA. This makes the regulator suitable for a wide range of battery powered applications where intermittent operation occurs. The shutdown control pin should not be taken to a voltage higher than Vin if low quiescent supply current is important. The shutdown control is a high impedance input and so if not required, should be wired to the ground pin (pin 7).



+ 5V
to 20V
Vin
Vout
Gnd
IC1
ZSR330
Microproc.
System
IC2
ZLDO330
LBF
Spg
SC
Gnd
Vin
D/C
N/C
Vout
C1
10pF
+ 3.3V
C3
100nF
C2
1uF
Switched
Output
Supply Input
0V
0V

Figure 4

4.85 VOLT ULTRA LOW DROPOUT REGULATOR

ZLDO485

ISSUE 1 - DECEMBER 1995

The ZLDO Series low dropout linear regulators operate with an exceptionally low dropout voltage, typically only 30mV with a load current of 100mA. The regulator series features output voltages in the range 3.3 to 18 volts, this device provides an output voltage of 4.85 volts.

The ZLDO485 consumes a typical quiescent current of only 630μA and is rated to supply load currents up to 300mA. A battery low flag is available to indicate potential power fail situations. If the input voltage falls to within 300mV of the regulated output voltage then the error output pulls low. The device also features an active high disable control. Once disabled the ZLDO quiescent current falls to typically 11μA.

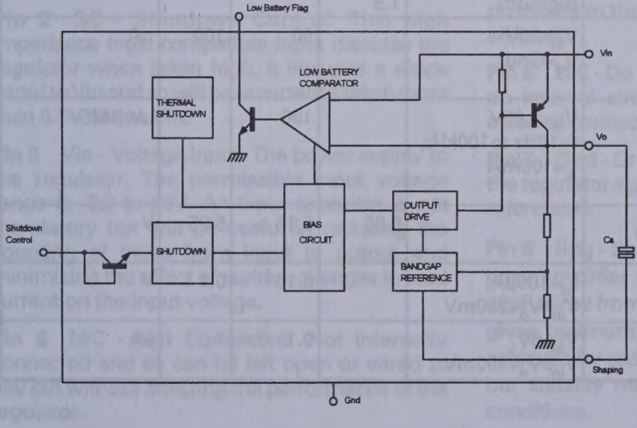
The ZLDO devices are packaged in Zetex SM8 8 pin small outline surface mount package, ideal for applications where space saving is important. The device low dropout voltage, low quiescent current and small size make it ideal for low power and battery powered applications. Battery powered circuits can make particular use of the low battery flag and shutdown features.

FEATURES

- Very low dropout voltage
- 6mV dropout at 10mA output
- 30mV dropout at 100mA output
- 100mV dropout at 300mA output
- 4.85 volt fixed output
- Other voltages available
- Low quiescent current
- Low battery flag
- Shutdown control
- Surface mount package

APPLICATIONS

- Battery powered devices
- Portable instruments
- Portable communications
- Laptop/Palmtop computers
- Electronic organisers



CONNECTION TABLE

Pin	
1	Low Battery Flag
2	Shutdown control
3	Vin
4	N/C
5	Vout
6	**Do not connect**
7	Gnd
8	Shaping
Pack	T8
see Diagrams Page 2 - 5	

ZLDO485

ABSOLUTE MAXIMUM RATING

Input Supply Voltage Range	-0.3 to 20V
Shutdown Input Voltage Range	-0.3 to Vin
Low Battery Output Voltage Range	-0.3 to 20V
Output Current	300mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 150°C
Power Dissipation (Tamb=25°C)	2W (Note 1)

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS (Unless otherwise stated) $T_{amb}=25°C, I_L=10mA, C_s=10pF, C_{out}=1\mu F$

Parameter	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output voltage	V_o	V_{in}=5.85V	4.75	4.85	4.95	V
Output voltage temperature coefficient	$\frac{V_o}{\Delta T}$	V_{in}=5.85V (Note 2, Note 4)		100	250	ppm/ °C
Line regulation	$\frac{V_{in}}{\Delta V_o}$	V_{in}=5.85 to 20V		4.85		mV/V
Load regulation	ΔV_o	I_L=10 to 300mA V_{in}=5.85V		97		mV
Dropout voltage (Note3)	V_{in}-V_o	I_L=10mA I_L=100mA I_L=300mA		6 30 100	10 75 200	mV
Quiescent current	I_q	V_{in}=5.85V, I_L=0		0.63	1	mA
Quiescent current at shutdown	I_{qs}	V_{in}=5.85V, I_L=0, V_{shdn}=V_{in}		11	30	µA
Shutdown control input current	I_{ins}	V_{shdn}=V_{in}=5.85V		2	10	µA
Shutdown control threshold voltage	V_{ts}	V_{in}=5.85V low(on) high(off)	 1.5		 0.4	V
Output current in shutdown mode (Note4)	I_{Ls}	V_{in}=20V V_o=Gnd		50	100	nA
Output noise voltage (Note4)	e_n	V_{in}=5.85V f=10Hz to100kHz, I_L=100mA		190		µV RMS
Low battery detect voltage	$V_{in(bld)}$		5.05	5.15	5.25	V
Low battery flag output voltage	V_{bl}	I_{bl}=100µA, V_{in}<V_o+200mV		0.16	0.4	V
Low battery flag leakage current	I_{bl}	V_{bl}=6V, V_{in}>V_o+400mV		0.1	1	µA

NOTES.

1. Maximum power dissipation of the device is calculated assuming the package is mounted on a PCB measuring 2 inches square.

2 Output voltage temperature coefficient is calculated as:- $\dfrac{V_O\ change\ x\ 1000000}{V_O\ x\ temperature\ change}$

3. Dropout voltage (See Definition of Terms (below))

4. Guaranteed by design.

DEFINITION OF TERMS

Dropout Voltage: The minimum input to output voltage differential for which the circuit will continue to regulate. The value is measured when the output voltage has dropped by 100mV from the nominal value obtained at Vin=6V.

Input Voltage: The DC voltage applied to the device input terminal with respect to ground.

Input To Output Voltage Differential: The difference between the applied unregulated input voltage and the regulated output voltage.

Line Regulation: The change in output voltage for a given change in input voltage.

Load Regulation: The change in output voltage for a given change in load current.

Output Noise Voltage: The R.M.S. AC output voltage measured over a defined frequency range, at constant load current and no input ripple.

Quiescent Current: The device input current minus the load current.

Output Voltage Temperature Coefficient: The change in output voltage with temperature over the operating temperature range of the device.

PIN DEFINITIONS

Pin 1 LBF - Low Battery Flag. An open collector NPN output which pulls low on failing input supply.

Pin 2 SC - Shutdown Control. This high impedance logic compatible input disables the regulator when taken high. It includes a diode wired to Vin and so will pass current if taken more than 0.5V above Vin.

Pin 3 Vin - Voltage Input. The power supply to the regulator. The permissible input voltage range is -0.3 to 20V. An input capacitor is not mandatory but will be useful in reducing the coupling of noise from input to output and minimising the effect of sudden changes in load current on the input voltage.

Pin 4 N/C - Not Connected. Not internally connected and so can be left open or wired to any pin without affecting the performance of the regulator.

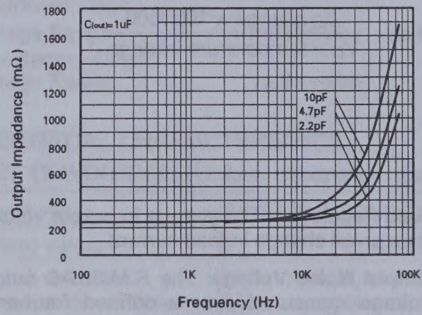
Pin 5 Vout - Voltage Output. The output of the regulator. An output capacitor of 1uF or greater and having low ESR should be wired in close proximity to the regulator to ensure stability for all loads.

Pin 6 D/C - Do Not Connect. This pin is wired to an internal circuit node of the regulator. No external connection should be made to this pin.

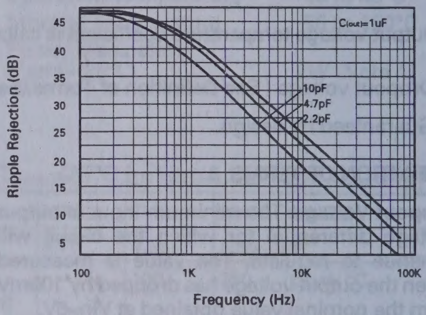
Pin 7 Gnd - Ground. The ground connection of the regulator against which the output voltage is referenced.

Pin 8 Spg - Shaping. The shaping node for the error amplifier of the regulator. A capacitor of 10pF wired from this pin to the output pin (pin 5) gives optimum stability. Improved AC can be achieved by reducing the value of this capacitor but stability may be impaired for some load conditions.

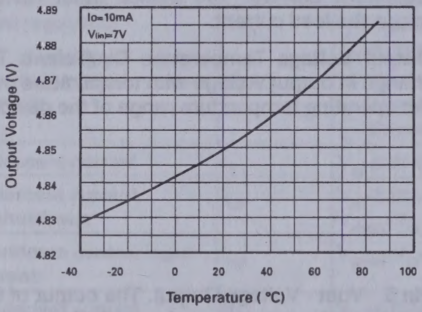
TYPICAL CHARACTERISTICS



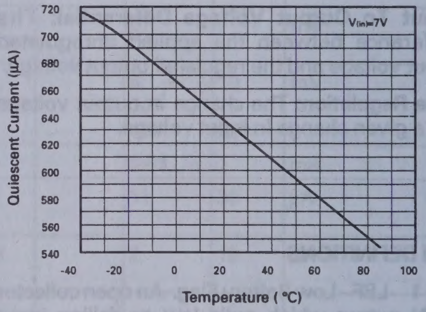
Output Impedance vs. Frequency



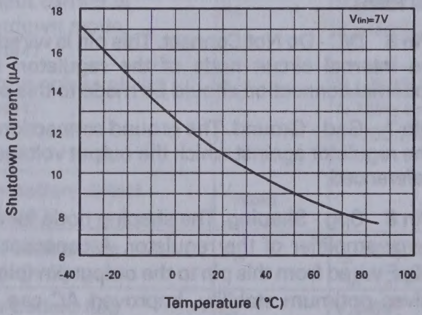
Ripple Rejection vs. Frequency



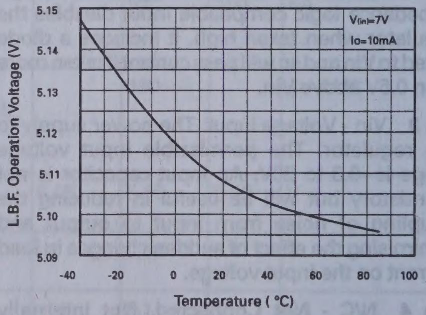
Output Voltage Temperature Coefficient



Quiescent Current vs. Temperature

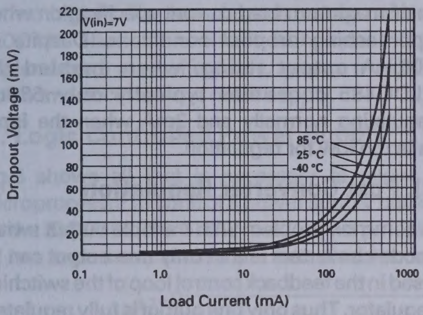


Shutdown Current vs. Temperature

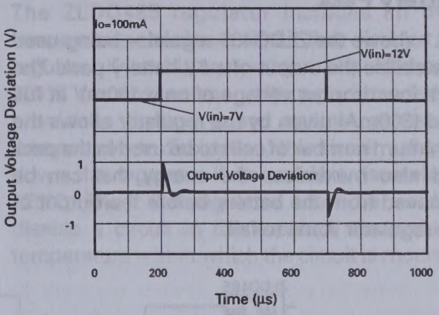


Low Battery Flag Operating Point

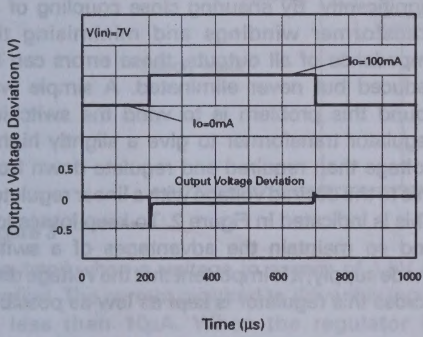
TYPICAL CHARACTERISTICS



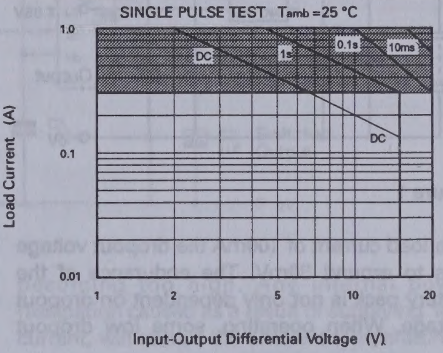
Dropout Voltage vs. Load Current



Line Transient Response



Load Transient Response



Safe Operating Area

Operation in shaded area is not guaranteed

APPLICATIONS

1). Operation From A Low Voltage Battery Pack

Fig.1 shows the ZLDO485 regulator being used to stabilise the output of a 6V battery pack. The ultra low dropout voltage of only 100mV at full load (300mA) given by the regulator allows the minimum number of cells to be used in the pack and also maximises the energy that can be removed from the battery before the output of the regulator starts to fail.

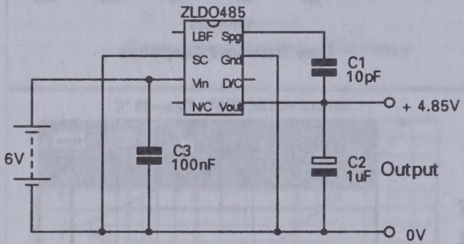

ZLDO485
LBF
Spg
SC
Gnd
Vin
D/C
N/C
Vout
C1
10pF
+ 4.85V
6V
C3
100nF
C2
1uF
Output
0V

Figure 1

At a load current of 100mA the dropout voltage falls to around 30mV. The endurance of the battery pack is not only dependent on dropout voltage. When operating, some low dropout regulators can consume high quiescent currents, sometimes approaching as much as a tenth of their maximum load current specification when approaching dropout conditions. Despite its 300mA output rating, when enabled the ZLDO485 consumes typically only 630uA regulating normally and 3mA when the input falls too low for regulation.

2). Post Converter Regulation

A common problem with multiple output switch mode converters is that only one output can be used in the feedback control loop of the switching regulator. Thus only one output is fully regulated. All other outputs are prone to tracking errors that occur if the load on any output change significantly. By ensuring close coupling of all transformer windings and minimising the impedance of all outputs, these errors can be reduced but never eliminated. A simple way round this problem is to wind the switching regulator transformer to give a slightly higher voltage than required and regulate down from this to the desired voltage with a linear regulator. This is indicated in Figure 2. To keep losses low and so maintain the advantages of a switch mode supply, it is important that the voltage drop across this regulator is kept as low as possible,

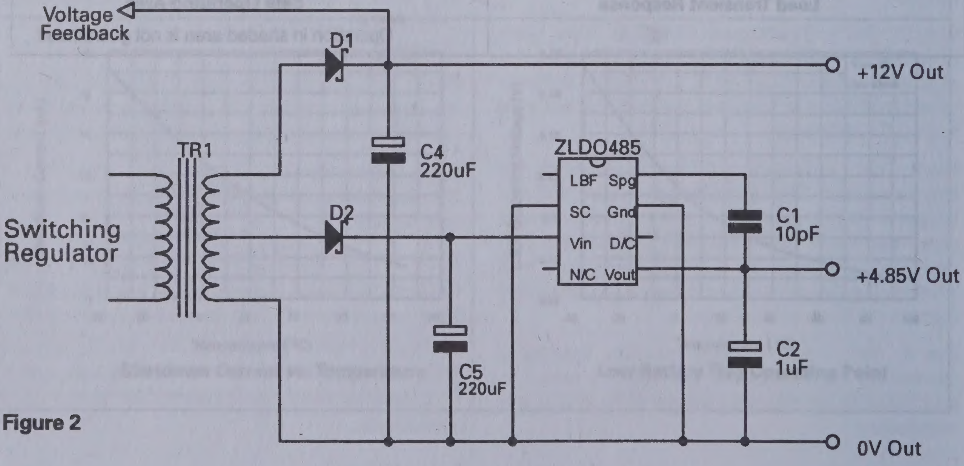

Voltage Feedback
D1
+12V Out
TR1
C4
220uF
Switching Regulator
D2
ZLDO485
LBF
Spg
SC
Gnd
Vin
D/C
N/C
Vout
C1
10pF
+4.85V Out
C5
220uF
C2
1uF
0V Out

Figure 2

i.e. just high enough to compensate for the poor output impedance of the switching power supply but no higher. The low dropout voltage of the ZLDO485 allows this circuit technique to be implemented very effectively, giving a highly stable and accurate low noise supply.

3). Logic Controlled Power Supply

Fig.3 shows all that is necessary to allow a microprocessor to control a power supply based on the ZLDO485 The Shutdown Control pin (pin 2), is a logic compatible input that disables the regulator when a voltage in excess of 1.5V is applied. The current required to drive this input is less than 10µA. When the regulator is shutdown in this way, the quiescent current of the ZLDO485 falls to around 11µA. This makes the regulator suitable for a wide range of battery powered applications where intermittent operation occurs. The shutdown control pin should not be taken to a voltage higher than Vin if low quiescent supply current is important. The shutdown control is a high impedance input and so if not required, should be wired to the ground pin (pin 7).

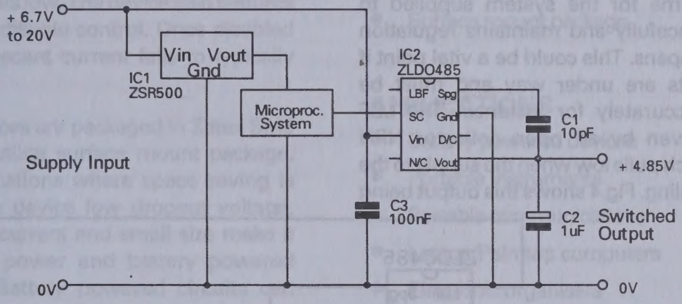


Figure 3

4). Over Temperature Shutdown

The ZLDO485 regulator includes an over temperature shutdown circuit that disables the regulator if its chip temperature should exceed 125°C for any reason. Although intended to provide a limited guard against excessive internal power dissipation, this circuit will shut down the regulator if its ambient rises above 125°C. Thus, the regulator could be used to disable a circuit in the event of the ambient temperature within which the circuit is mounted becoming too high. Any internal power dissipation caused as a result of supplying load current, will reduce the ambient temperature at which shutdown occurs. Note that to achieve the extremely low dropout voltage and high current performance provided by the ZLDO485 devices, the parts can be damaged by sustained output shorts or excessive loads when combined with high input supply voltages. To ensure reliable operation, keep loads within the SOA graph boundaries Indicated in the typical characteristics.

5). Low Battery Flag

The ZLDO485 provides an output called Low Battery Flag (LBF). Unlike many regulators that only signal that they are falling out of regulation, the LBF output of the ZLDO485 series indicates that the voltage drop across the regulator has fallen to less than typically 300mV and so supply failure is imminent. This improved warning gives both more time for the system supplied to shutdown gracefully and maintains regulation while this happens. This could be a vital point if measurements are under way and must be completed accurately for instance. The LBF output is driven by an open collector NPN transistor which pulls low when the supply to the regulator is failing. Fig.4 shows this output being used. Note that resistor R1 is necessary only if the interrupt logic does not include a pull-up resistor.

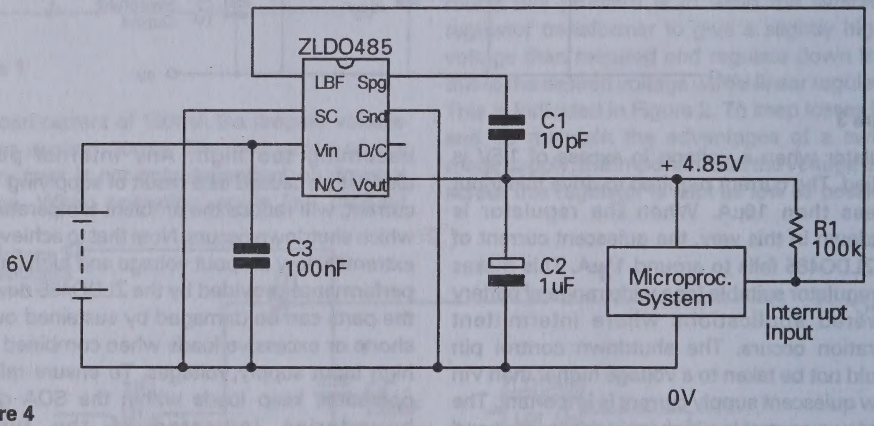

ZLDO485
LBF
Spg
SC
Gnd
Vin
D/C
N/C
Vout
C1
10pF
6V
C3
100nF
+ 4.85V
R1
100k
C2
1uF
Microproc.
System
Interrupt
Input
0V

Figure 4

5.0 VOLT ULTRA LOW DROPOUT REGULATOR

ZLDO500

ISSUE 1 - DECEMBER 1995

The ZLDO Series low dropout linear regulators operate with an exceptionally low dropout voltage, typically only 30mV with a load current of 100mA. The regulator series features output voltages in the range 3.3 to 18 volts, this device provides an output voltage of 5.0 volts.

The ZLDO500 consumes a typical quiescent current of only 630μA and is rated to supply load currents up to 300mA. A battery low flag is available to indicate potential power fail situations. If the input voltage falls to within 300mV of the regulated output voltage then the error output pulls low. The device also features an active high disable control. Once disabled the ZLDO quiescent current falls to typically 11μA.

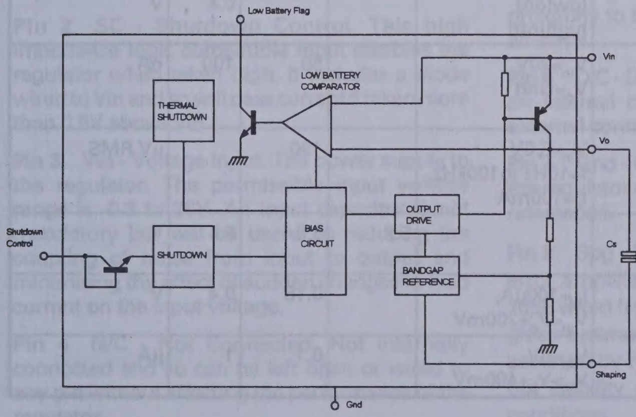
The ZLDO devices are packaged in Zetex SM8 8 pin small outline surface mount package, ideal for applications where space saving is important. The device low dropout voltage, low quiescent current and small size make it ideal for low power and battery powered applications. Battery powered circuits can make particular use of the low battery flag and shutdown features.

FEATURES

- Very low dropout voltage
- 6mV dropout at 10mA output
- 30mV dropout at 100mA output
- 100mV dropout at 300mA output
- 5.0 volt fixed output
- Other voltages available
- Low quiescent current
- Low battery Iflag
- Shutdown control
- Surface mount package

APPLICATIONS

- Battery powered devices
- Portable instruments
- Portable communications
- Laptop/Palmtop computers
- Electronic organisers



CONNECTION TABLE

Pin	
1	Low Battery Flag
2	Shutdown control
3	Vin
4	N/C
5	Vout
6	**Do not connect**
7	Gnd
8	Shaping
Pack	T8

see Diagrams Page 2 - 5

ZLDO500

ABSOLUTE MAXIMUM RATING

Input Supply Voltage Range	-0.3 to 20V
Shutdown Input Voltage Range	-0.3 to Vin
Low Battery Output Voltage Range	-0.3 to 20V
Output Current	300mA
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 150°C
Power Dissipation (Tamb=25°C)	2W (Note 1)

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS (Unless otherwise stated) $T_{amb}=25°C, I_L=10mA, C_s=10pF, C_{out}=1\mu F$

Parameter	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output voltage	V_o	V_{in}=6.0V	4.9	5.0	5.1	V
Output voltage temperature coefficient	$\frac{V_o}{\Delta T}$	V_{in}=6.0V (Note 2, Note 4)		100	250	ppm/ °C
Line regulation	$\frac{V_{in}}{\Delta V_o}$	V_{in}=6.0 to 20V		5		mV/V
Load regulation	ΔV_o	I_L=10 to 300mA V_{in}=4.3V		100		mV
Dropout voltage (Note3)	V_{in}-V_o	I_L=10mA I_L=100mA I_L=300mA		6 30 100	10 75 200	mV
Quiescent current	I_q	V_{in}=6.0V, I_L=0		0.63	1	mA
Quiescent current at shutdown	I_{qs}	V_{in}=6.0V, I_L=0, V_{shdn}=V_{in}		11	30	µA
Shutdown control input current	I_{ins}	V_{shdn}=V_{in}=6.0V		2	10	µA
Shutdown control threshold voltage	V_{ts}	V_{in}=6.0V low(on) high(off)	 1.5		 0.4	V
Output current in shutdown mode (Note4)	I_{Ls}	V_{in}=20V V_o=Gnd		50	100	nA
Output noise voltage (Note4)	e_n	V_{in}=6.0V f=10Hz to100kHz, I_L=100mA		190		µV RMS
Low battery detect voltage	$V_{in(bld)}$		5.2	5.3	5.4	V
Low battery flag output voltage	V_{bl}	I_{bl}=100µA, V_{in}<V_o+200mV		0.16	0.4	V
Low battery flag leakage current	I_{bl}	V_{bl}=6V, V_{in}>V_o+400mV		0.1	1	µA

NOTES.

1. Maximum power dissipation of the device is calculated assuming the package is mounted on a PCB measuring 2 inches square.

2 Output voltage temperature coefficient is calculated as:- $\dfrac{V_O\ \text{change}\ \times 1000000}{V_O \times \text{temperature change}}$

3. Dropout voltage (See Definition of Terms (below))

4. Guaranteed by design.

DEFINITION OF TERMS

Dropout Voltage: The minimum input to output voltage differential for which the circuit will continue to regulate. The value is measured when the output voltage has dropped by 100mV from the nominal value obtained at Vin=6V.

Input Voltage: The DC voltage applied to the device input terminal with respect to ground.

Input To Output Voltage Differential: The difference between the applied unregulated input voltage and the regulated output voltage.

Line Regulation: The change in output voltage for a given change in input voltage.

Load Regulation: The change in output voltage for a given change in load current.

Output Noise Voltage: The R.M.S. AC output voltage measured over a defined frequency range, at constant load current and no input ripple.

Quiescent Current: The device input current minus the load current.

Output Voltage Temperature Coefficient: The change in output voltage with temperature over the operating temperature range of the device.

PIN DEFINITIONS

Pin 1 LBF - Low Battery Flag. An open collector NPN output which pulls low on failing input supply.

Pin 2 SC - Shutdown Control. This high impedance logic compatible input disables the regulator when taken high. It includes a diode wired to Vin and so will pass current if taken more than 0.5V above Vin.

Pin 3 Vin - Voltage Input. The power supply to the regulator. The permissible input voltage range is -0.3 to 20V. An input capacitor is not mandatory but will be useful in reducing the coupling of noise from input to output and minimising the effect of sudden changes in load current on the input voltage.

Pin 4 N/C - Not Connected. Not internally connected and so can be left open or wired to any pin without affecting the performance of the regulator.

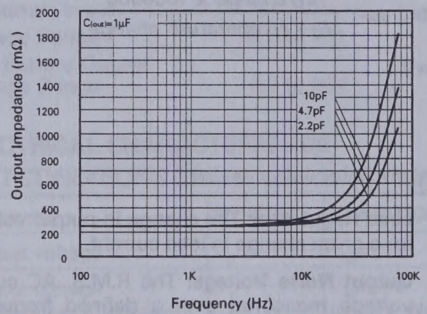
Pin 5 Vout - Voltage Output. The output of the regulator. An output capacitor of 1uF or greater and having low ESR should be wired in close proximity to the regulator to ensure stability for all loads.

Pin 6 D/C - Do Not Connect. This pin is wired to an internal circuit node of the regulator. No external connection should be made to this pin.

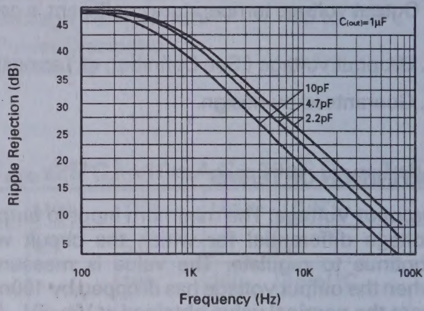
Pin 7 Gnd - Ground. The ground connection of the regulator against which the output voltage is referenced.

Pin 8 Spg - Shaping. The shaping node for the error amplifier of the regulator. A capacitor of 10pF wired from this pin to the output pin (pin 5) gives optimum stability. Improved AC can be achieved by reducing the value of this capacitor but stability may be impaired for some load conditions.

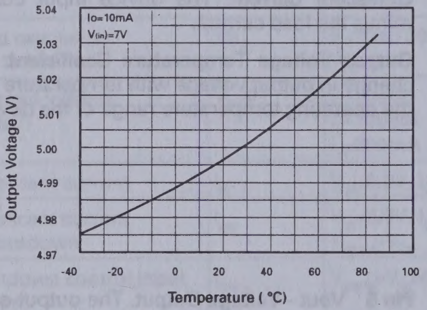
TYPICAL CHARACTERISTICS



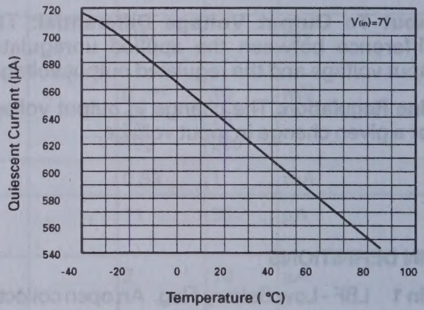
Output Impedance vs. Frequency



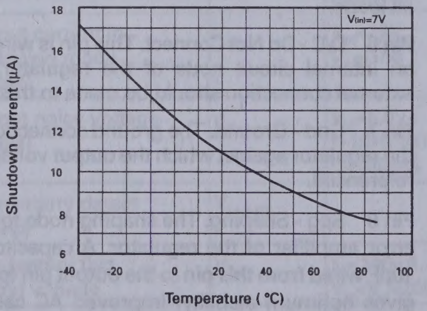
Ripple Rejection vs. Frequency



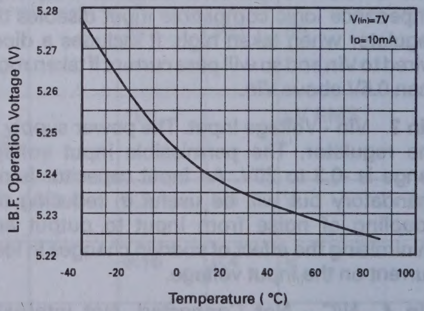
Output Voltage Temperature Coefficient



Quiescent Current vs. Temperature

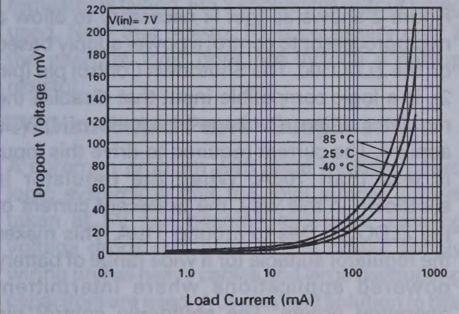


Shutdown Current vs. Temperature

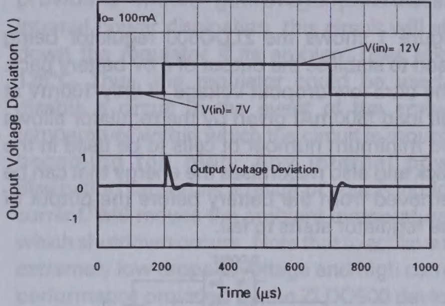


Low Battery Flag Operating Point

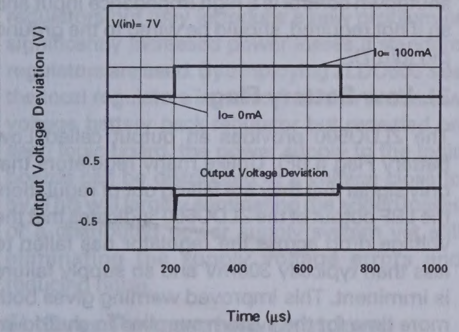
TYPICAL CHARACTERISTICS



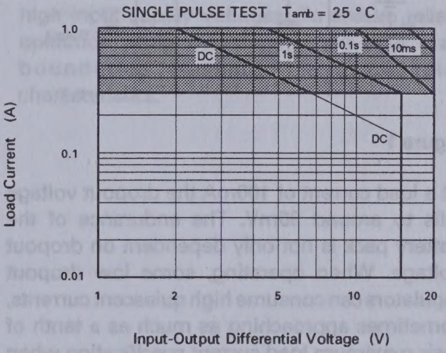
Dropout Voltage vs. Load Current



Line Transient Response



Load Transient Response



Safe Operating Area

Operation in shaded area is not guaranteed

APPLICATIONS

1). Operation From A Low Voltage Battery Pack

Figure 1 shows the ZLDO500 regulator being used to stabilise the output of a 6V battery pack. The ultra low dropout voltage of only 100mV at full load (300mA) given by the regulator allows the minimum number of cells to be used in the pack and also maximises the energy that can be removed from the battery before the output of the regulator starts to fail.

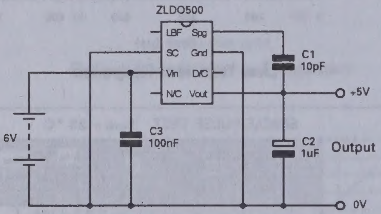


Figure 1

At a load current of 100mA the dropout voltage falls to around 30mV. The endurance of the battery pack is not only dependent on dropout voltage. When operating, some low dropout regulators can consume high quiescent currents, sometimes approaching as much as a tenth of their maximum load current specification when approaching dropout conditions. Despite its 300mA output rating, when enabled the ZLDO500 consumes typically only 630µA regulating normally and 3mA when the input falls too low for regulation.

2). Logic Controlled Power Supply

Figure 2 shows all that is necessary to allow a microprocessor to control a power supply based on the ZLDO500. The Shutdown Control pin (pin 2), is a logic compatible input that disables the regulator when a voltage in excess of 1.5V is applied. The current required to drive this input is less than 10µA. When the regulator is shutdown in this way, the quiescent current of the ZLDO500 falls to around 11µA. This makes the regulator suitable for a wide range of battery powered applications where intermittent operation occurs. The shutdown control pin should not be taken to a voltage higher than Vin if low quiescent supply current is important. The shutdown control is a high impedance input and so if not required, should be wired to the ground pin (pin 7).

3). Low Battery Flag

The ZLDO500 provides an output called Low Battery Flag (LBF). Unlike many regulators that only signal that they are falling out of regulation, the LBF output of the ZLDO500 indicates that the voltage drop across the regulator has fallen to less than typically 300mV and so supply failure is imminent. This improved warning gives both more time for the system supplied to shutdown gracefully and maintains regulation while this happens. This could be a vital point if measurements are under way and must be completed accurately for instance. The LBF output is driven by an open collector NPN

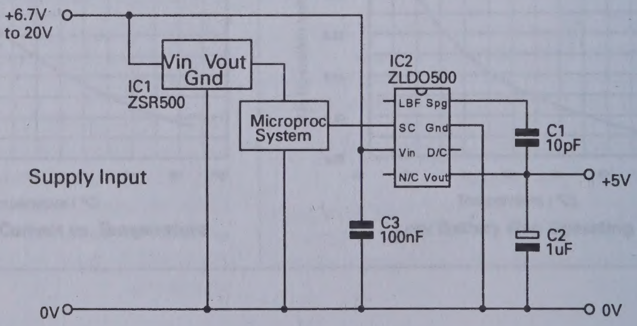


Figure 2

APPLICATIONS

transistor which pulls low when the supply to the regulator is failing. Fig.3 shows this output being used. Note that resistor R1 is necessary only if the interrupt logic does not include a pull-up resistor.

4). Distributed Power Supplies

A common problem with large multiple board logic systems is that the total supply current taken at 5V can become excessive, causing voltage drops and noise in the power supply wiring unless heavy cables and large decoupling capacitors are used. A convenient solution to this problem is to provide power using a higher voltage supply locally regulated to 5V. Voltage drops and noise are now eliminated by the regulators but they introduce a new problem of significantly increased power losses if standard regulators are used. By employing ZLDO500's as the local regulators in a circuit similar to the low voltage battery pack regulator but repeated on each logic board, the power supply to the logic boards can be distributed at a voltage close to 5V. This will largely eliminating the added losses of a distributed power supply system yet still eliminating the supply voltage errors and reducing noise.

5). Over Temperature Shutdown

The ZLDO500 regulator includes an over temperature shutdown circuit that disables the regulator if its chip temperature should exceed 125°C for any reason. Although intended to provide a limited guard against excessive internal power dissipation, this circuit will shut down the regulator if its ambient rises above 125°C. Thus, the regulator could be used to disable a circuit in the event of the ambient temperature within which the circuit is mounted becoming too high. Any internal power dissipation caused as a result of supplying load current, will reduce the ambient temperature at which shutdown occurs. Note that to achieve the extremely low dropout voltage and high current performance provided by the ZLDO500 devices, the parts can be damaged by sustained output shorts or excessive loads when combined with high input supply voltages. To ensure reliable operation, keep loads within the SOA graph boundaries indicated in the typical characteristics.

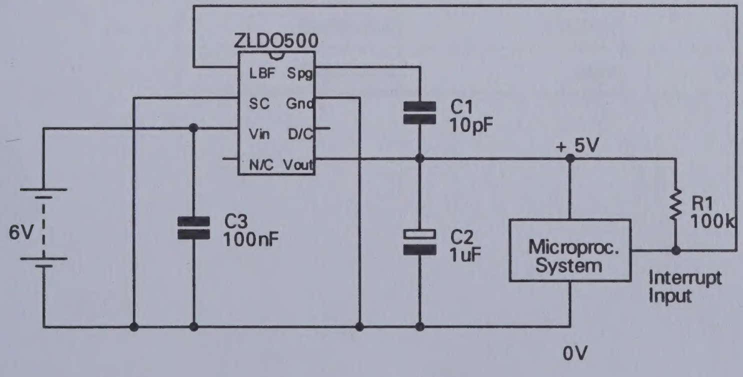


Figure 3

Section 3

Supply Voltage Monitors

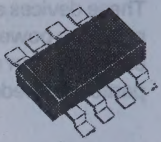
These devices are three terminal voltage monitoring circuits for use in microprocessor systems. They provide a power on reset function and produce a system reset on power fail. The circuit design enables easy selection of both threshold voltage and hysteresis level so devices can be provided to suit the particular needs of many systems and supply voltages.

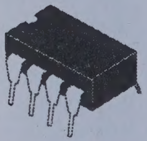
Selection guide

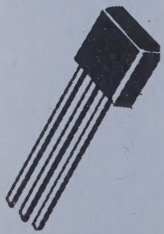
Part No	Typical Supply Voltage (V)	Threshold Voltage (V)	Typical Hysteresis (mV)	Maximum Output Sink Current (mA)	Input Voltage Range (V)	Maximum Quiescent Current (µA)
ZSM300	3	2.63	20	60	1 to 6.5	190
ZSM330	3.3	3.1	20	60	1 to 6.5	180
ZSM530	5	4.3	20	60	1 to 6.5	260
ZSM560	5	4.6	20	60	1 to 6.5	200
ZSM561	5	4.6	20	60	1 to 7	200
ZM33064	5	4.6	20	60	1 to 6.5	200
ZM33164	5	4.3	60	50	1 to 10	260
ZM33164-3	3	2.68	60	50	1 to 10	190

Supply Voltage Monitor Ordering Information

Part Number	**Package**	**Part Mark**
ZSM300C	TO92	ZSM300
ZSM300G	SOT223	ZSM300
ZSM300N8	SO8	ZSM300
ZSM330C	TO92	ZSM330
ZSM330G	SOT223	ZSM330
ZSM330N8	SO8	ZSM330
ZSM530C	TO92	ZSM530
ZSM530G	SOT223	ZSM530
ZSM530N8	SO8	ZSM530
ZSM560C	TO92	ZSM560
ZSM560G	SOT223	ZSM560
ZSM560N8	SO8	ZSM560
ZSM561C	TO92	ZSM561
ZSM561G	SOT223	ZSM561
ZSM561N8	SO8	ZSM561
ZM33064C	TO92	ZM33064
ZM33064G	SOT223	ZM33064
ZM33064N8	SO8	ZM33064
ZM33164C	TO92	ZM33164
ZM33164G	SOT223	ZM33164
ZM33164N8	SO8	ZM33164
ZM331643C	TO92	ZM331643
ZM331643G	SOT223	ZM331643
ZM331643N8	SO8	ZM331643

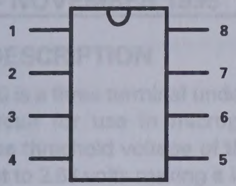






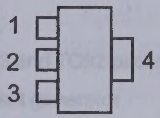
Supply Voltage Monitor Connection Diagrams

SO8 Package Suffix – N8



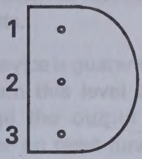
Top View

SOT223 Package Suffix – G



Top View –
Pin 4 floating or connected to pin 2

TO92 Package Suffix – C



Bottom View

SUPPLY VOLTAGE MONITOR

ZSM300

ISSUE 1 – NOVEMBER 1995

DEVICE DESCRIPTION

The ZSM300 is a three terminal under voltage monitor circuit for use in microprocessor systems. The threshold voltage of the device has been set to 2.63 volts making it ideal for 3 volt circuits.

Included in the device is a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The ZSM300 features on open collector output capable of sinking at least l0mA which only requires a single external resistor to interface to following circuits.

Operation of the device is guaranteed from one volt upwards, from this level to the device threshold voltage the output is held low providing a power on reset function. Should the supply voltage, once established, at any time drop below the threshold level then the output again will pull low.

The device is available in a TO92 package for through hole applications as well as SO8 and SOT223 for surface mount requirements.

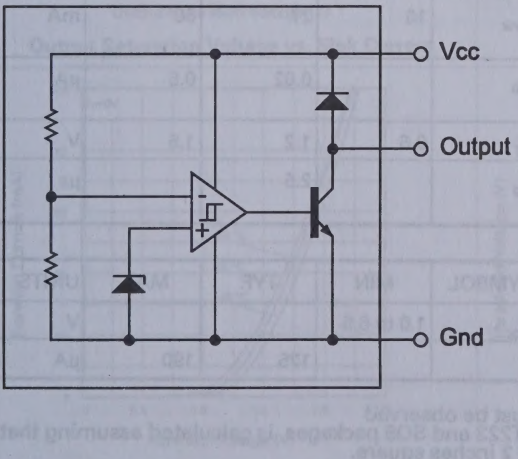
FEATURES

- SO8, SOT223 and TO92 packages
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 2.63 volt threshold for 3 volt logic
- 20mV hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	Out	Vcc	Gnd
2	Vcc	Gnd	Vcc
3	N/C	Out	Out
4	Gnd	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	N/C	–	–
Pack	N8	G	C

see Diagrams Page 3 - 3

ABSOLUTE MAXIMUM RATING

Input Supply Voltage	-1 to 10V
Offstate Output Voltage	10V
Onstate Output Sink Current(Note 1)	Internally limited
Clamp diode Forward Current(Note 1)	100mA
Operating junction temperature	150°C
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 150°C

Power Dissipation	
TO92	780mW
SOT223	2W(Note 2)
SO8	780mW(Note 2)

TEST CONDITIONS

(T_{amb}=25°C for typical values, T_{amb}=-40 to 85°C for min/max values (Note3))

COMPARATOR

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Threshold Voltage High state output (V_{cc} increasing)	V_{IH}	2.56	2.64	2.7	V
Threshold Voltage Low state output (V_{cc} decreasing)	V_{IL}	2.56	2.62	2.7	V
Hysteresis	V_H	0.01	0.02	0.05	V

OUPUT

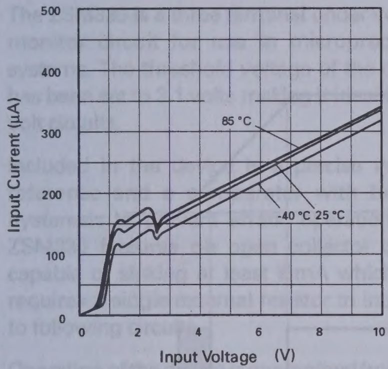
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Output sink saturation:	V_{OL}				
(V_{cc}=2.2V, I_{sink}=8.0mA)			0.46	1.0	V
(V_{cc}=2.2V, I_{sink}=2.0mA)			0.15	0.4	V
(V_{cc}=1.0V, I_{sink}=0.1mA)				0.25	V
Onstate output sink current (V_{cc}, Output=2.2V)	I_{sink}	10	27	60	mA
Offstate output leakage current (V_{cc}, Output=3V)	I_{oh}		0.02	0.5	µA
Clamp diode forward voltage (I_f=10mA)	V_f	0.6	1.2	1.5	V
Propagation delay (V_{in} 3V to 2.2V, R_l=10k, T_{amb}=25°C)	T_d		2.5		µs

TOTAL DEVICE

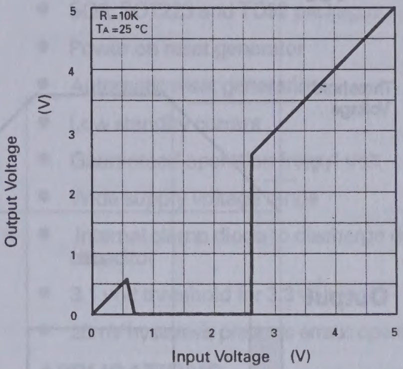
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Operating input voltage range	V_{cc}	1.0 to 6.5			V
Quiescent input current (V_{cc}=3V)	I_q		125	190	µA

Note:
1. Maximum package power dissipation must be observed
2. Maximum power dissipation, for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.
3. Low duty cycle pulse techniques are used during test to maintain junction temperatures as close to ambient as possible

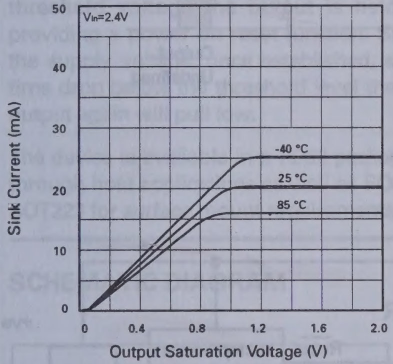
TYPICAL CHARACTERISTICS



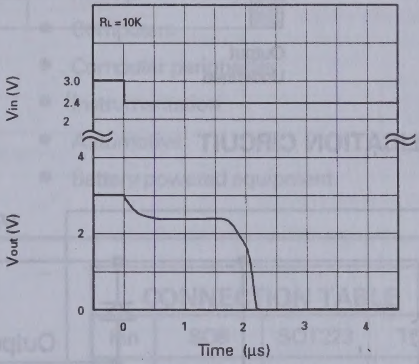
Input Current vs. Input Voltage



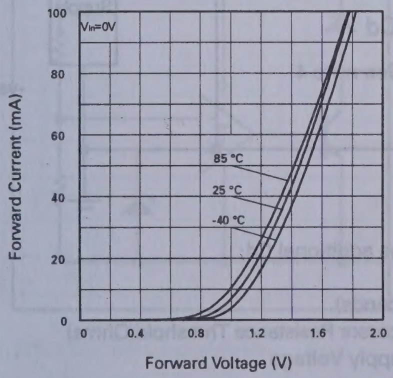
Output Voltage vs. Input Voltage



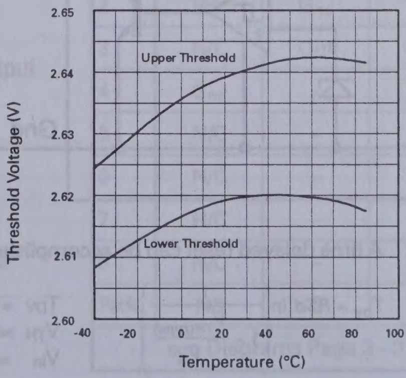
Output Saturation Voltage vs. Sink Current



Reset Delay Time

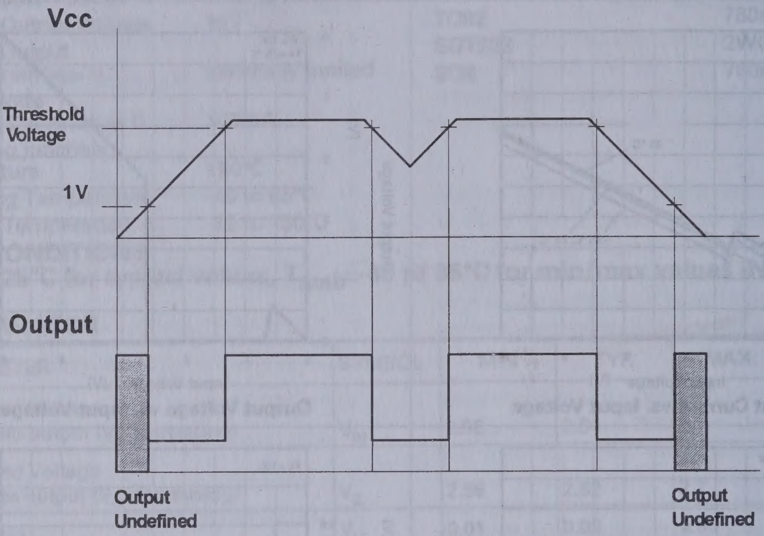


Clamp Diode Forward Current vs. Voltage

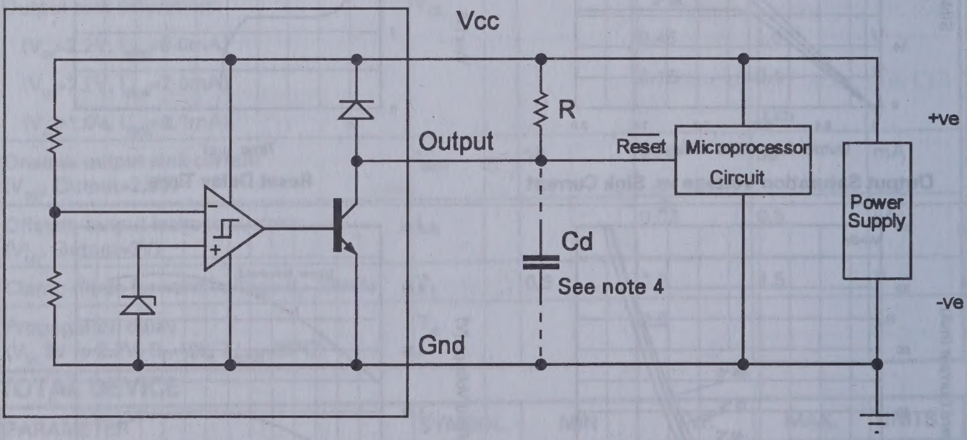


Threshold Voltage vs. Temperature

TIMING DIAGRAM


Vcc
Threshold Voltage
1 V
Output
Output Undefined
Output Undefined

APPLICATION CIRCUIT


Vcc
Output
Gnd
R
Cd
See note 4
Reset
Microprocessor Circuit
Power Supply
+ve
-ve

Note 4: A time delayed reset can be accomplished with the additional Cd.

$$T_{DY} = RCd \ln\left(\frac{1}{1 - \frac{V_{TH(mpu)}}{V_{in}}}\right)$$

T_{DY} =Time (Seconds)
V_{TH} =Microprocessor Resistance Threshold(Ohms)
V_{in} =Power Supply Voltage

SUPPLY VOLTAGE MONITOR

ZSM330

ISSUE 1 – NOVEMBER 1995

DEVICE DESCRIPTION

The ZSM330 is a three terminal under voltage monitor circuit for use in microprocessor systems. The threshold voltage of the device has been set to 3.1 volts making it ideal for 3.3 volt circuits.

Included in the device is a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The ZSM330 features on open collector output capable of sinking at least l0mA which only requires a single external resistor to interface to following circuits.

Operation of the device is guaranteed from one volt upwards, from this level to the device threshold voltage the output is held low providing a power on reset function. Should the supply voltage, once established, at any time drop below the threshold level then the output again will pull low.

The device is available in a TO92 package for through hole applications as well as SO8 and SOT223 for surface mount requirements.

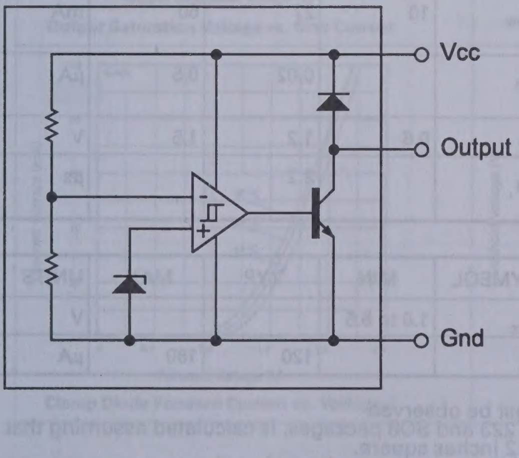
FEATURES

- SO8, SOT223 and TO92 packages
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 3.1 volt threshold for 3.3 volt logic
- 20mV hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	Out	Vcc	Gnd
2	Vcc	Gnd	Vcc
3	N/C	Out	Out
4	Gnd	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	N/C	–	–
Pack	N8	G	C
see Diagrams Page 3 - 3			

ZSM330

ABSOLUTE MAXIMUM RATING

Input Supply Voltage	-1 to 10V
Offstate Output Voltage	10V
Onstate Output Sink Current(Note 1)	Internally limited
Clamp diode Forward Current(Note 1)	100mA
Operating junction temperature	150°C
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 150°C

Power Dissipation	
TO92	780mW
SOT223	2W(Note 2)
SO8	780mW(Note 2)

TEST CONDITIONS
(T_{amb}=25°C for typical values, T_{amb}=-40 to 85°C for min/max values (Note3))

COMPARATOR

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Threshold Voltage High state output (V_{cc} increasing)	V_{IH}	3.01	3.09	3.15	V
Threshold Voltage Low state output (V_{cc} decreasing)	V_{IL}	3.01	3.07	3.15	V
Hysteresis	V_H	0.01	0.02	0.05	V

OUPUT

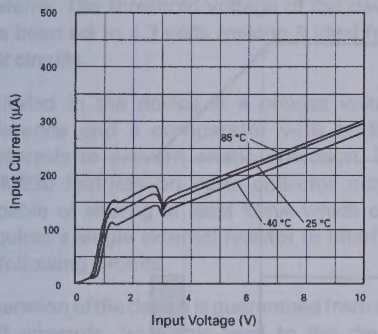
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Output sink saturation:	V_{OL}				
(V_{cc}=2.7V, I_{sink}=8.0mA)			0.46	1.0	V
(V_{cc}=2.7V, I_{sink}=2.0mA)			0.15	0.4	V
(V_{cc}=1.0V, I_{sink}=0.1mA)				0.25	V
Onstate output sink current (V_{cc}, Output=2.7V)	I_{sink}	10	27	60	mA
Offstate output leakage current (V_{cc}, Output=3.3V)	I_{oh}		0.02	0.5	µA
Clamp diode forward voltage (I_f=10mA)	V_f	0.6	1.2	1.5	V
Propagation delay (V_{in} 3.3V to 2.7V, R_l=10k, T_{amb}=25°C)	T_d		2.2		µs

TOTAL DEVICE

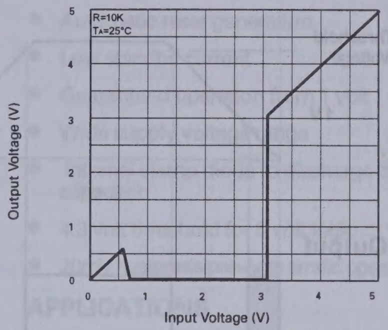
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Operating input voltage range	V_{cc}	1.0 to 6.5			V
Quiescent input current (V_{cc}=3.3V)	I_q		120	180	µA

Note:
1. Maximum package power dissipation must be observed
2. Maximum power dissipation, for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.
3. Low duty cycle pulse techniques are used during test to maintain junction temperatures as close to ambient as possible

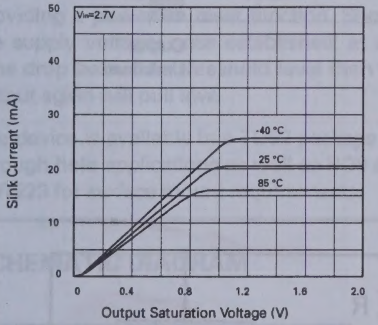
TYPICAL CHARACTERISTICS



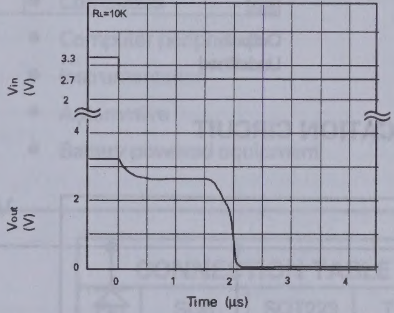
Input Current vs. Input Voltage



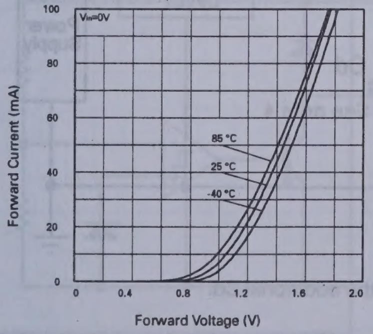
Output Voltage vs. Input Voltage



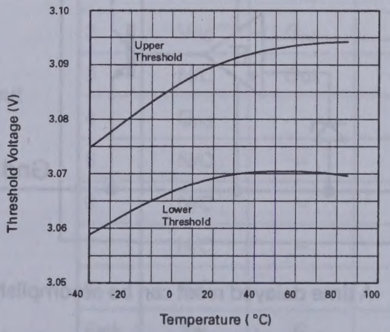
Output Saturation Voltage vs. Sink Current



Reset Delay Time

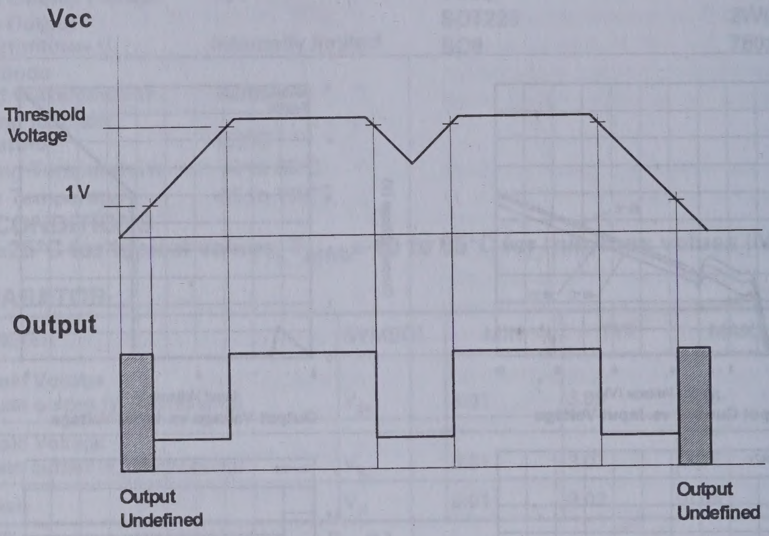


Clamp Diode Forward Current vs. Voltage

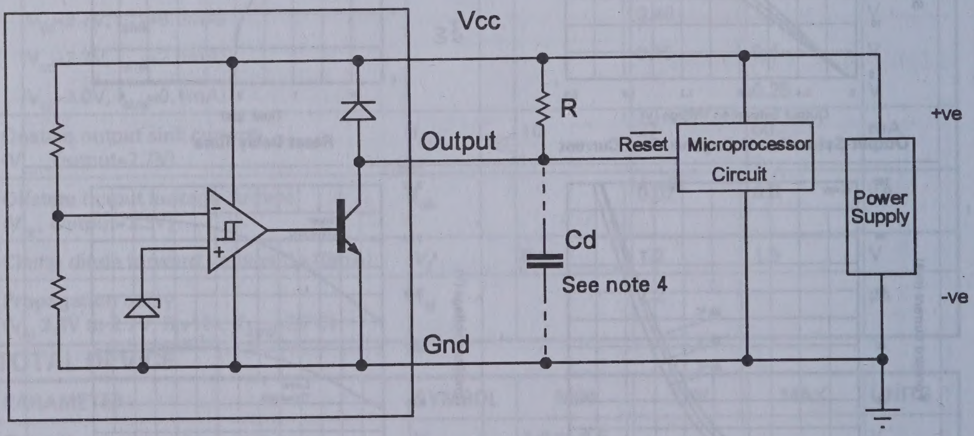


Threshold Voltage vs. Temperature

TIMING DIAGRAM


Vcc
Threshold Voltage
1 V
Output
Output Undefined
Output Undefined

APPLICATION CIRCUIT


Vcc
R
Output
Reset
Microprocessor Circuit
+ve
Power Supply
-ve
Cd
See note 4
Gnd

Note 4: A time delayed reset can be accomplished with the additional Cd.

$$T_{DY} = RCd \ln\left(\frac{1}{1-\frac{V_{TH(mpu)}}{V_{in}}}\right)$$

T_{DY} =Time (Seconds)

V_{TH} =Microprocessor Resistance Threshold(Ohms)

V_{in} =Power Supply Voltage

SUPPLY VOLTAGE MONITOR

ISSUE 1 – NOVEMBER 1995

ZSM530

DEVICE DESCRIPTION

The ZSM530 is a three terminal under voltage monitor circuit for use in microprocessor systems. The threshold voltage of the device has been set to 4.3 volts making it ideal for 5 volt circuits.

Included in the device is a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The ZSM530 features on open collector output capable of sinking at least 10mA which only requires a single external resistor to interface to following circuits.

Operation of the device is guaranteed from one volt upwards, from this level to the device threshold voltage the output is held low providing a power on reset function. Should the supply voltage, once established, at any time drop below the threshold level then the output again will pull low.

The device is available in a TO92 package for through hole applications as well as SO8 and SOT223 for surface mount requirements.

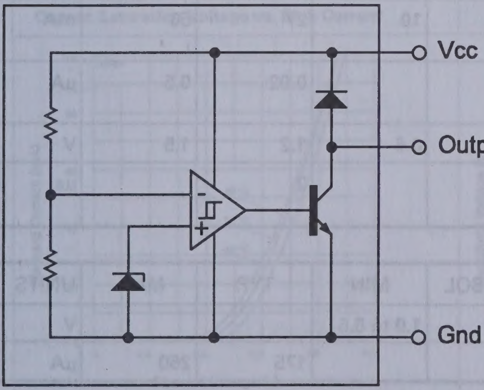
FEATURES

- SO8, SOT223 and TO92 packages
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.3 volt threshold for 5 volt logic
- 20mV hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	Out	Vcc	Gnd
2	Vcc	Gnd	Vcc
3	N/C	Out	Out
4	Gnd	–	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	N/C	–	–
Pack	N8	G	C

see Diagrams Page 3 - 3

ZSM530

ABSOLUTE MAXIMUM RATING

Input Supply Voltage	-1 to 10V
Offstate Output Voltage	10V
Onstate Output Sink Current(Note 1)	Internally limited
Clamp diode Forward Current(Note 1)	100mA
Operating junction temperature	150°C
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 150°C

Power Dissipation	
TO92	780mW
SOT223	2W(Note 2)
SO8	780mW(Note 2)

TEST CONDITIONS
(T_{amb}=25°C for typical values, T_{amb}=-40 to 85°C for min/max values (Note3))

COMPARATOR

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Threshold Voltage High state output (V_{cc} increasing)	V_{IH}	4.2	4.31	4.4	V
Threshold Voltage Low state output (V_{cc} decreasing)	V_{IL}	4.2	4.29	4.4	V
Hysteresis	V_H	0.01	0.02	0.05	V

OUPUT

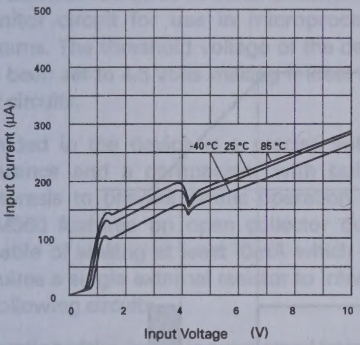
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Output sink saturation:	V_{OL}				
(V_{cc}=3.8V, I_{sink}=8.0mA)			0.46	1.0	V
(V_{cc}=3.8V, I_{sink}=2.0mA)			0.15	0.4	V
(V_{cc}=1.0V, I_{sink}=0.1mA)				0.25	V
Onstate output sink current (V_{cc}, Output=3.8V)	I_{sink}	10	27	60	mA
Offstate output leakage current (V_{cc}, Output=5V)	I_{oh}		0.02	0.5	µA
Clamp diode forward voltage (I_f=10mA)	V_f	0.6	1.2	1.5	V
Propagation delay (V_{in} 5V to 3.8V, R_l=10k, T_{amb}=25°C)	T_d		2		µs

TOTAL DEVICE

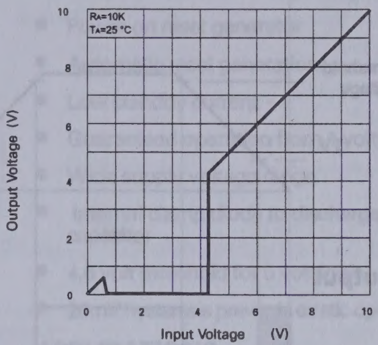
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Operating input voltage range	V_{cc}	1.0 to 6.5			V
Quiescent input current (V_{cc}=5V)	I_q		175	260	µA

Note:
1. Maximum package power dissipation must be observed
2. Maximum power dissipation, for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.
3. Low duty cycle pulse techniques are used during test to maintain junction temperatures as close to ambient as possible

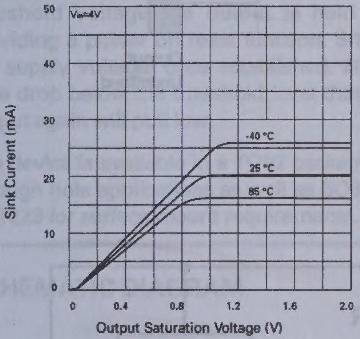
TYPICAL CHARACTERISTICS



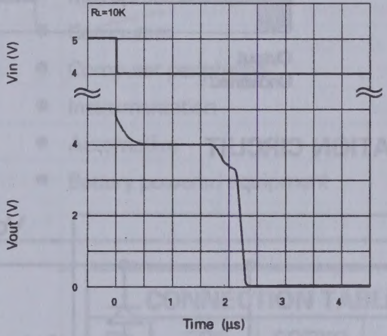
Input Current vs. Input Voltage



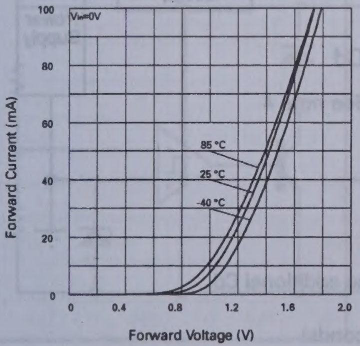
Output Voltage vs. Input Voltage



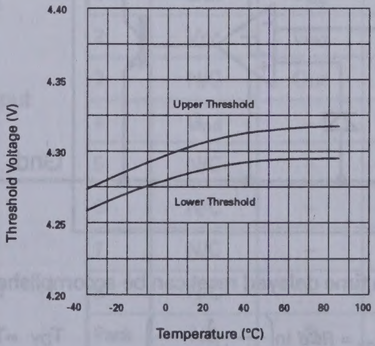
Output Saturation Voltage vs. Sink Current



Reset Delay Time

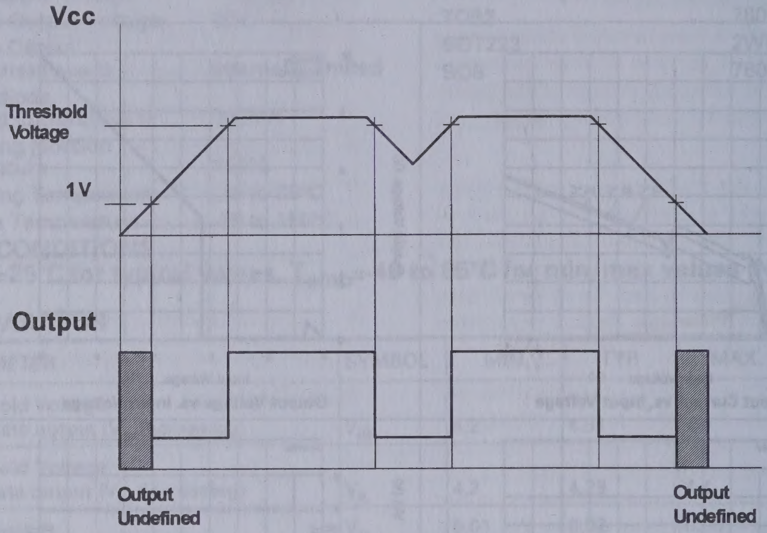


Clamp Diode Forward Current vs. Voltage

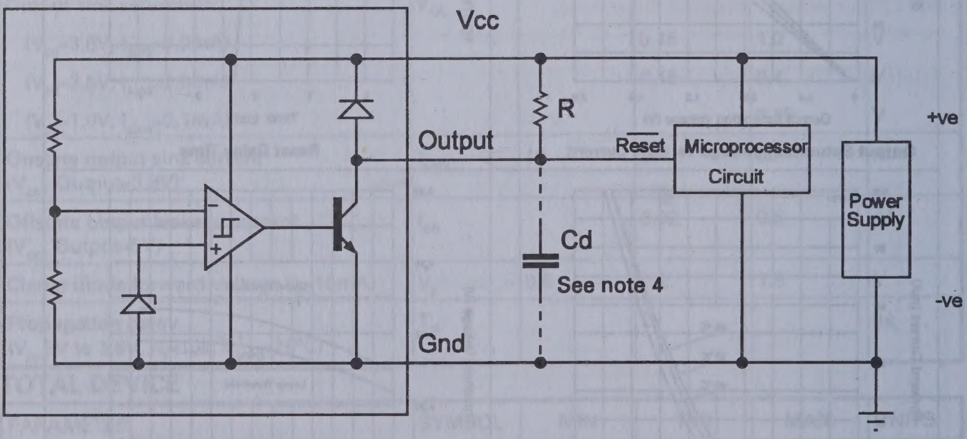


Threshold Voltage vs. Temperature

TIMING DIAGRAM


Vcc
Threshold Voltage
1 V
Output
Output Undefined
Output Undefined

APPLICATION CIRCUIT


Vcc
R
Output
$\overline{\text{Reset}}$
Microprocessor Circuit
+ve
Power Supply
-ve
Cd
See note 4
Gnd

Note 4: A time delayed reset can be accomplished with the additional Cd.

$$T_{DY} = RCd\ \ln\left(\frac{1}{1-\frac{V_{TH(mpu)}}{V_{in}}}\right)$$

T_{DY} =Time (Seconds)
V_{TH} =Microprocessor Resistance Threshold(Ohms)
V_{in} =Power Supply Voltage

SUPPLY VOLTAGE MONITOR

ZSM560

ISSUE 2 – NOVEMBER 1995

DEVICE DESCRIPTION

The ZSM560 is a three terminal under voltage monitor circuit for use in microprocessor systems. The threshold voltage of the device has been set to 4.6 volts making it ideal for 5 volt circuits.

Included in the device is a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The ZSM560 features on open collector output capable of sinking at least l0mA which only requires a single external resistor to interface to following circuits.

Operation of the device is guaranteed from one volt upwards, from this level to the device threshold voltage the output is held low providing a power on reset function. Should the supply voltage, once established, at any time drop below the threshold level then the output again will pull low.

The device is available in a TO92 package for through hole applications as well as SO8 and SOT223 for surface mount requirements.

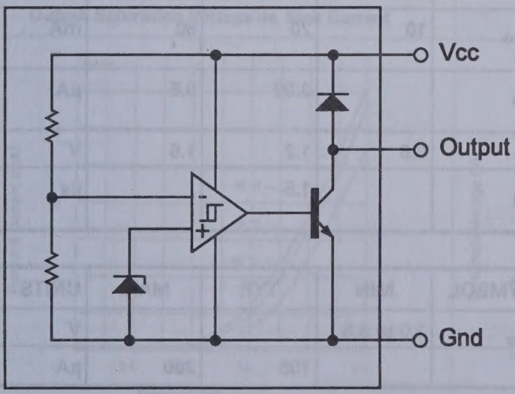
FEATURES

- SO8, SOT223 and TO92 packages
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.6 volt threshold for 5 volt logic
- 20mV hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	Out	V_{CC}	G_{nd}
2	V_{CC}	G_{nd}	V_{CC}
3	N/C	Out	Out
4	G_{nd}	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	N/C	–	–
Pack	N8	G	C

see Diagrams Page 3 - 3

ZSM560

ABSOLUTE MAXIMUM RATING

Input Supply Voltage	-1 to 10V
Offstate Output Voltage	10V
Onstate Output Sink Current(Note 1)	Internally limited
Clamp diode Forward Current(Note 1)	100mA
Operating junction temperature	150°C
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 150°C

Power Dissipation	
TO92	780mW
SOT223	2W(Note 2)
SO8	780mW(Note 2)

TEST CONDITIONS
(T_{amb}=25°C for typical values, T_{amb}=-40 to 85°C for min/max values (Note3))

COMPARATOR

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Threshold Voltage High state output (Vcc increasing)	V_{IH}	4.5	4.61	4.7	V
Threshold Voltage Low state output (Vcc decreasing)	V_{IL}	4.5	4.59	4.7	V
Hysteresis	V_H	0.01	0.02	0.05	V

OUPUT

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Output sink saturation:	V_{OL}				
(V_{cc}=4.0V, I_{sink}=8.0mA)			0.46	1.0	V
(V_{cc}=4.0V, I_{sink}=2.0mA)			0.15	0.4	V
(V_{cc}=1.0V, I_{sink}=0.1mA)				0.25	V
Onstate output sink current (V_{cc}, Output=4V)	I_{sink}	10	20	60	mA
Offstate output leakage current (V_{cc}, Output=5V)	I_{oh}		0.02	0.5	μA
Clamp diode forward voltage (I_f=10mA)	V_f	0.6	1.2	1.5	V
Propagation delay (V_{in} 5V to 4V, R_l=10k, T_{amb}=25°C)	T_d		1.5		μs

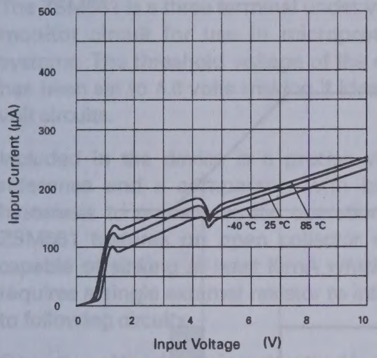
TOTAL DEVICE

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Operating input voltage range	V_{cc}	1.0 to 6.5			V
Quiescent input current (V_{cc}=5V)	I_q		135	200	μA

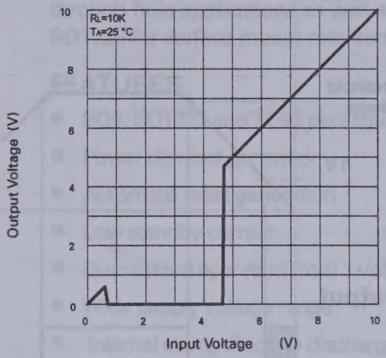
Note:

1. Maximum package power dissipation must be observed
2. Maximum power dissipation, for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.
3. Low duty cycle pulse techniques are used during test to maintain junction temperatures as close to ambient as possible

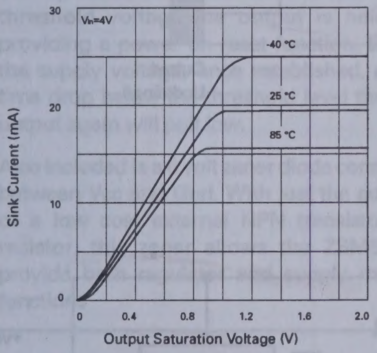
TYPICAL CHARACTERISTICS



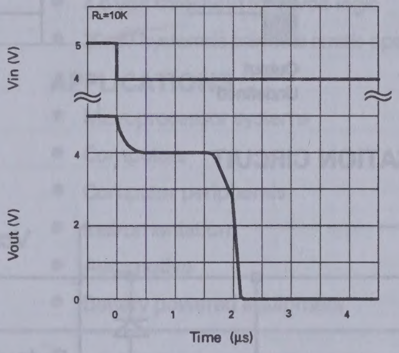
Input Current vs. Input Voltage



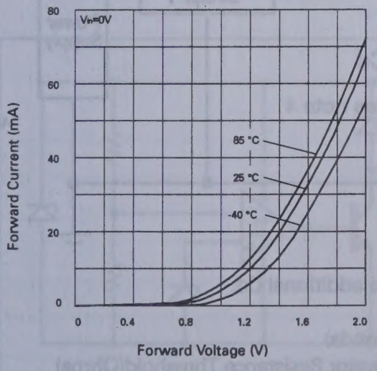
Output Voltage vs. Input Voltage



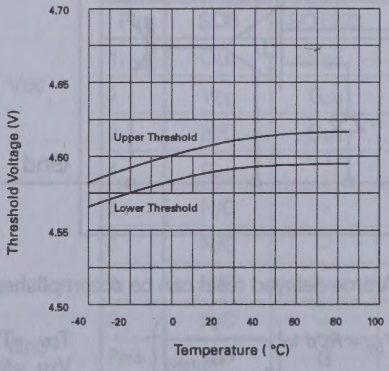
Output Saturation Voltage vs. Sink Current



Reset Delay Time

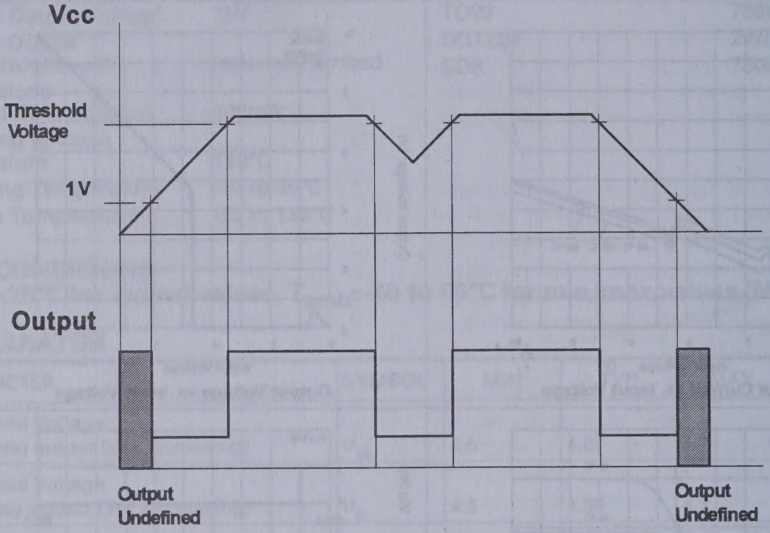


Clamp Diode Forward Current vs. Voltage

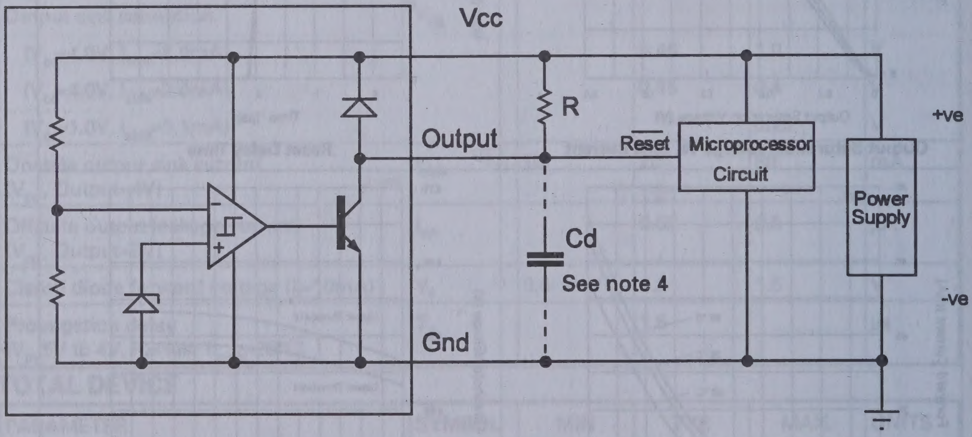


Threshold Voltage vs. Temperature

TIMING DIAGRAM


Vcc
Threshold Voltage
1 V
Output
Output Undefined
Output Undefined

APPLICATION CIRCUIT


Vcc
Output
R
$\overline{\text{Reset}}$
Microprocessor Circuit
+ve
Power Supply
-ve
Cd
See note 4
Gnd

Note 4: A time delayed reset can be accomplished with the additional Cd.

$$T_{DY} = RCd \ln\left(\frac{1}{1-\frac{V_{TH(mpu)}}{V_{in}}}\right)$$

T_{DY} =Time (Seconds)

V_{TH} =Microprocessor Resistance Threshold(Ohms)

V_{in} =Power Supply Voltage

SUPPLY VOLTAGE MONITOR

ZSM561

ISSUE 2 – NOVEMBER 1995

DEVICE DESCRIPTION

The ZSM561 is a three terminal under voltage monitor circuit for use in microprocessor systems. The threshold voltage of the device has been set to 4.6 volts making it ideal for 5 volt circuits.

Included in the device is a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The ZSM561 features on open collector output capable of sinking at least 10mA which only requires a single external resistor to interface to following circuits.

Operation of the device is guaranteed from one volt upwards, from this level to the device threshold voltage the output is held low providing a power on reset function. Should the supply voltage, once established, at any time drop below the threshold level then the output again will pull low.

Also included is a 6 volt zener diode connected between Vcc and Gnd. With just the addition of a low cost external NPN transistor and resistor, this zener allows the ZSM561 to provide both regulator and supply monitor functions

The device is available in a TO92 package for through hole applications as well as SO8 and SOT223 for surface mount requirements.

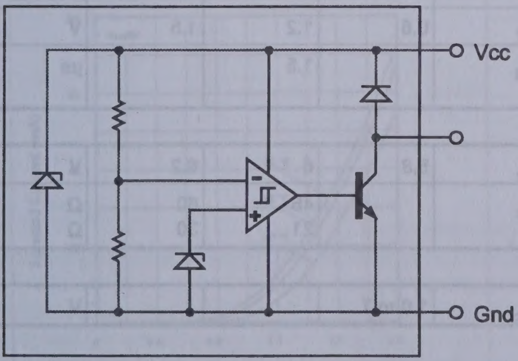
FEATURES

- SO8, SOT223 and TO92 packages
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.6 volt threshold for 5 volt logic
- 20mV hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



CONNECTION TABLE			
Pin	SO8	SOT223	TO92
1	Out	Vcc	Gnd
2	Vcc	Gnd	Vcc
3	N/C	Out	Out
4	Gnd	–	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	N/C	–	–
Pack	N8	G	C
see Diagrams Page 3 - 3			

ABSOLUTE MAXIMUM RATING

Input Supply Voltage	-1 to 7V
Supply zener current	25mA continuous
Offstate Output Voltage	7V
Onstate Output Sink Current(Note 1)	Internally limited
Clamp diode Forward Current(Note 1)	100mA
Operating junction temperature	150°C
Operating Temperature	-40 to 85°C
Storage Temperature	-65 to 150°C

Power Dissipation	
TO92	780mW
SOT223	2W(Note 2)
SO8	780mW(Note 2)

TEST CONDITIONS
(T_{amb}=25°C for typical values, T_{amb}=-40 to 85°C for min/max values (Note3))

COMPARATOR

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Threshold Voltage High state output (Vcc increasing)	V_{IH}	4.5	4.61	4.7	V
Threshold Voltage Low state output (Vcc decreasing)	V_{IL}	4.5	4.59	4.7	V
Hysteresis	V_H	0.01	0.02	0.05	V

OUPUT

Output sink saturation:	V_{OL}				
(V_{cc}=4.0V, I_{sink}=8.0mA)			0.46	1.0	V
(V_{cc}=4.0V, I_{sink}=2.0mA)			0.15	0.4	V
(V_{cc}=1.0V, I_{sink}=0.1mA)				0.25	V
Onstate output sink current (V_{cc}, Output=4V)	I_{sink}	10	20	60	mA
Offstate output leakage current (V_{cc}, Output=5V)	I_{oh}		0.02	0.5	µA
Clamp diode forward voltage (I_f=10mA)	V_f	0.6	1.2	1.5	V
Propagation delay (V_{in} 5V to 4V, R_l=10k, T_{amb}=25°C)	T_d		1.5		µs

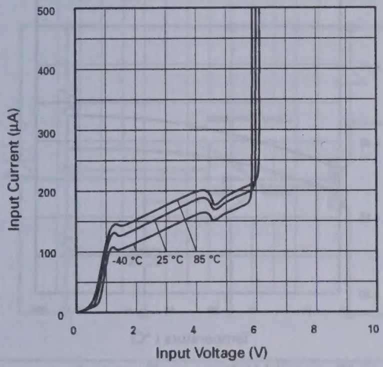
SUPPLY ZENER

Avalanche Voltage:(Icc=1mA)	V_z	5.8	6	6.2	V
Slope Resistance: (Icc=15mA) (Icc=15mA to 50mA)	R_z		45 21	60 30	Ω Ω

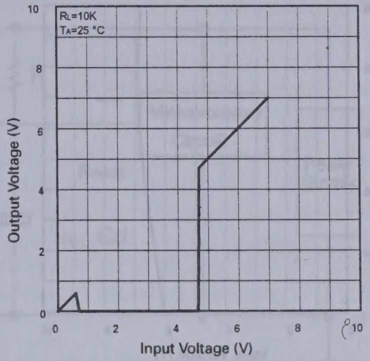
TOTAL DEVICE

Operating input voltage range(Note 5)	V_{cc}	1.0 to 7			V

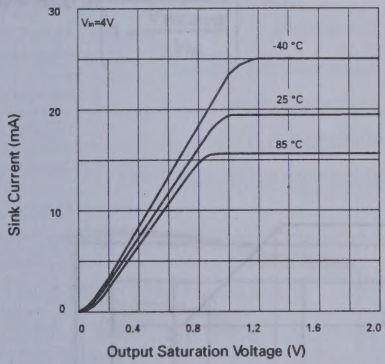
TYPICAL CHARACTERISTICS



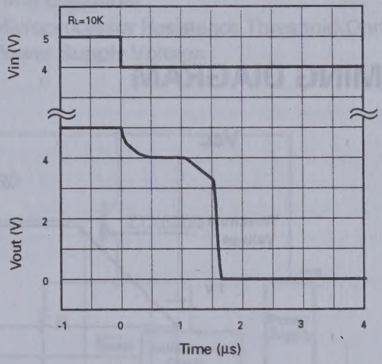
Input Current vs. Input Voltage



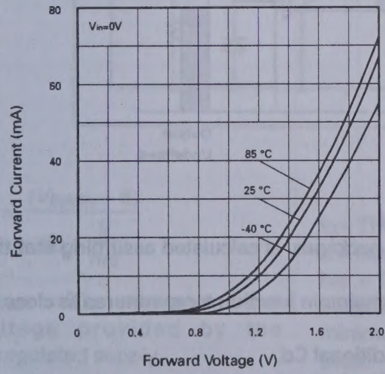
Output Voltage vs. Input Voltage



Output Saturation Voltage vs. Sink Current

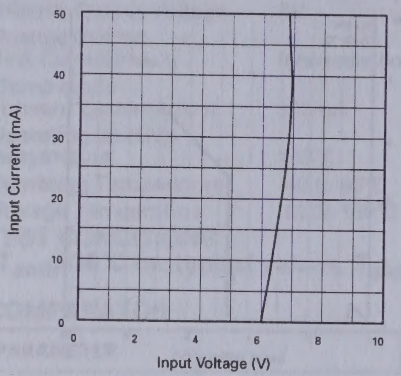


Reset Delay Time

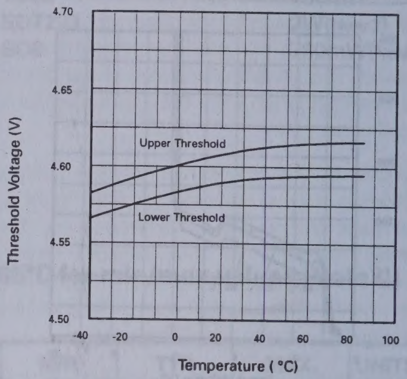


Clamp Diode Forward Current vs. Voltage

TYPICAL CHARACTERISTICS

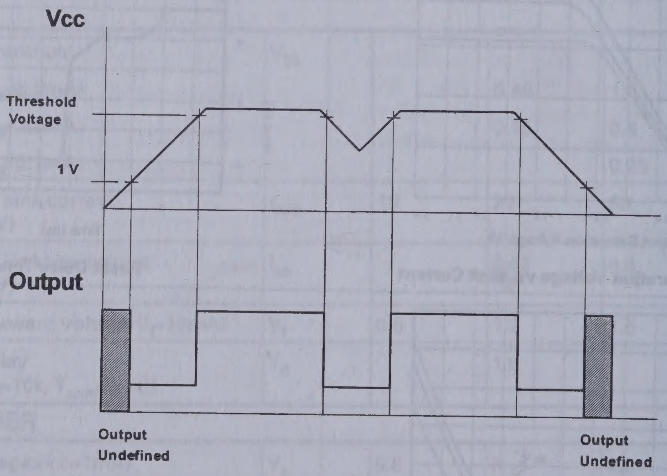


Input Current vs. Input Voltage



Threshold Voltage vs. Temperature

TIMING DIAGRAM


Vcc
Threshold Voltage
1 V
Output
Output Undefined
Output Undefined

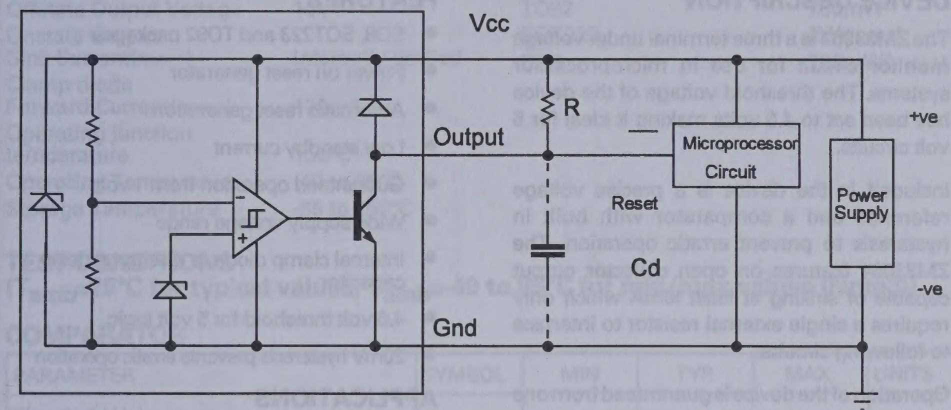
Note:

1. Maximum package power dissipation must be observed
2. Maximum power dissipation, for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.
3. Low duty cycle pulse techniques are used during test to maintain junction temperatures as close to ambient as possible

4: A time delayed reset can be accomplished with the additional Cd.

5 Operation above V_Z may be restricted by the supply current rating I_Z

APPLICATION CIRCUITS

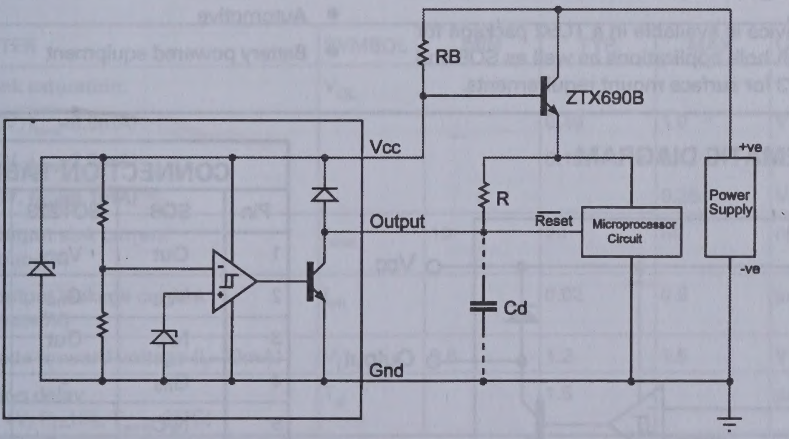

Vcc
R
+ve
Output
Microprocessor Circuit
Power Supply
Reset
Cd
-ve
Gnd

$$T_{DY} = RCd \ln\left(\frac{1}{1-\frac{V_{TH(mpu)}}{V_{in}}}\right)$$

T_{DY} =Time (Seconds)

V_{TH} =Microprocessor Resistance Threshold(Ohms)

V_{in} =Power Supply Voltage


RB
ZTX690B
Vcc
+ve
R
Output
Reset
Microprocessor Circuit
Power Supply
-ve
Cd
Gnd

$$R_B = \frac{(V_{INMIN} - 6)}{(I_Q + \frac{I_L}{h_{FE}})}$$

V_{INMIN} = The minimum input voltage provided by the unregulated supply.

I_Q = The ZSM561 quiescent current (ie 200 µA)

I_L = Load current taken by the microprocessor system

h_{FE} = The minimum h_{FE} that can be expected from the pass transistor under worst case conditions. (ie Lowest temperature and minimum input voltage).For the ZTX690B a value of 250 could be used.

SUPPLY VOLTAGE MONITOR

ZM33064

ISSUE 2 – NOVEMBER 1995

DEVICE DESCRIPTION

The ZM33064 is a three terminal under voltage monitor circuit for use in microprocessor systems. The threshold voltage of the device has been set to 4.6 volts making it ideal for 5 volt circuits.

Included in the device is a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The ZM33064 features on open collector output capable of sinking at least l0mA which only requires a single external resistor to interface to following circuits.

Operation of the device is guaranteed from one volt upwards, from this level to the device threshold voltage the output is held low providing a power on reset function. Should the supply voltage, once established, at any time drop below the threshold level then the output again will pull low.

The device is available in a TO92 package for through hole applications as well as SO8 and SOT223 for surface mount requirements.

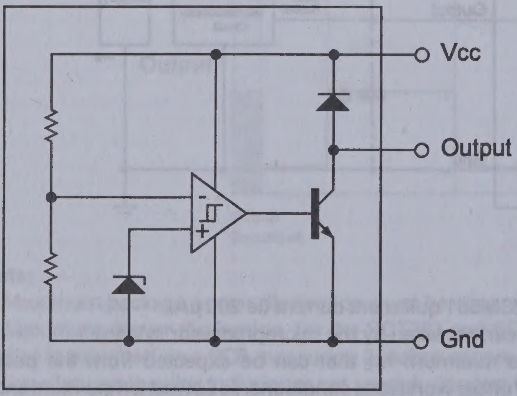
FEATURES

- SO8, SOT223 and TO92 packages
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.6 volt threshold for 5 volt logic
- 20mV hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	Out	V_{CC}	G_{nd}
2	V_{CC}	G_{nd}	V_{CC}
3	N/C	Out	Out
4	G_{nd}	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	N/C	–	–
Pack	N8	G	C
	see Diagrams Page 3 - 3		

ABSOLUTE MAXIMUM RATING

Input Supply Voltage	-1 to 10V
Offstate Output Voltage	10V
Onstate Output Sink Current(Note 1)	Internally limited
Clamp diode Forward Current(Note 1)	100mA
Operating junction temperature	150°C
Operating Temperature	-40 to 85°C
Storage Temperature	-65 to 150°C

Power Dissipation	
TO92	780mW
SOT223	2W(Note 2)
SO8	780mW(Note 2)

TEST CONDITIONS
(T_{amb}=25°C for typical values, T_{amb}=-40 to 85°C for min/max values (Note3))

COMPARATOR

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Threshold Voltage High state output (Vcc increasing)	V_{IH}	4.5	4.61	4.7	V
Threshold Voltage Low state output (Vcc decreasing)	V_{IL}	4.5	4.59	4.7	V
Hysteresis	V_H	0.01	0.02	0.05	V

OUPUT

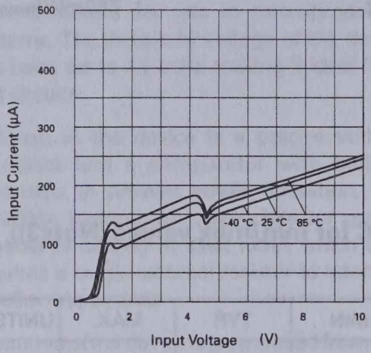
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Output sink saturation:	V_{OL}				
(V_{cc}=4.0V, I_{sink}=8.0mA)			0.46	1.0	V
(V_{cc}=4.0V, I_{sink}=2.0mA)			0.15	0.4	V
(V_{cc}=1.0V, I_{sink}=0.1mA)				0.25	V
Onstate output sink current (V_{cc}, Output=4V)	I_{sink}	10	20	60	mA
Offstate output leakage current (V_{cc}, Output=5V)	I_{oh}		0.02	0.5	µA
Clamp diode forward voltage (I_f=10mA)	V_f	0.6	1.2	1.5	V
Propagation delay (V_{in} 5V to 4V, R_l=10k, T_{amb}=25°C)	T_d		1.5		µs

TOTAL DEVICE

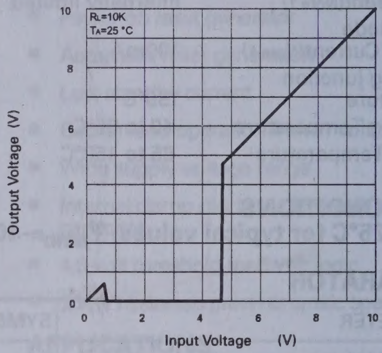
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Operating input voltage range	V_{cc}	1.0 to 6.5			V
Quiescent input current (V_{cc}=5V)	I_q		135	200	µA

Note:
1. Maximum package power dissipation must be observed
2. Maximum power dissipation, for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.
3. Low duty cycle pulse techniques are used during test to maintain junction temperatures as close to ambient as possible

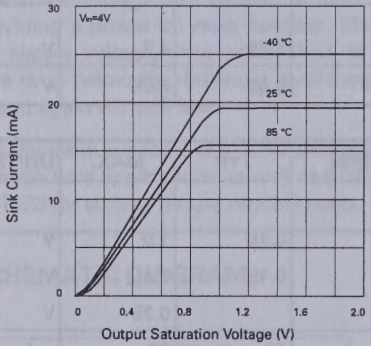
TYPICAL CHARACTERISTICS



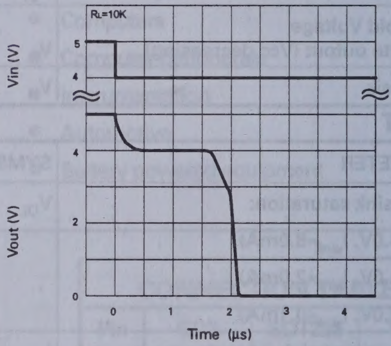
Input Current vs. Input Voltage



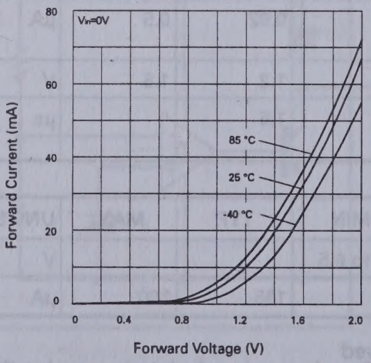
Output Voltage vs. Input Voltage



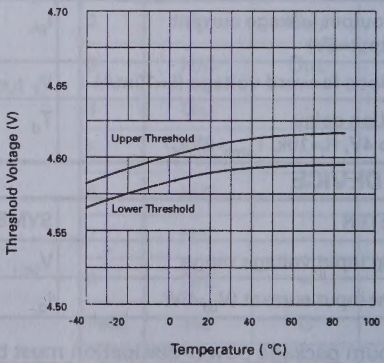
Output Saturation Voltage vs. Sink Current



Reset Delay Time

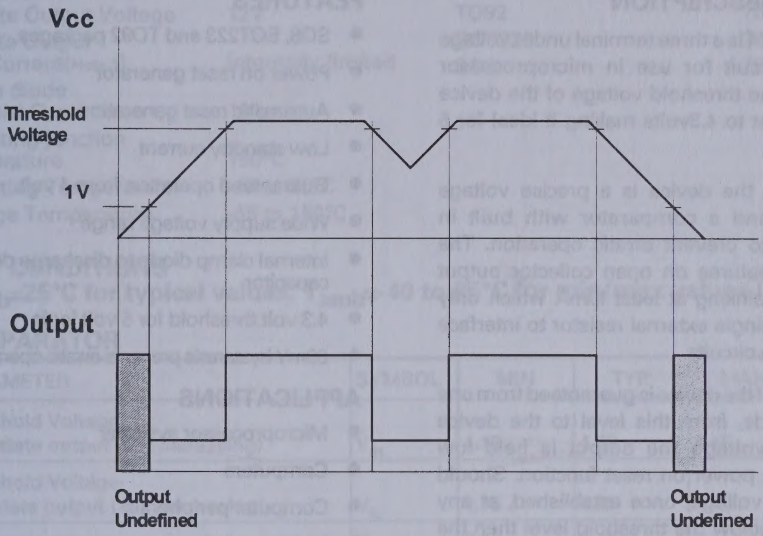


Clamp Diode Forward Current vs. Voltage

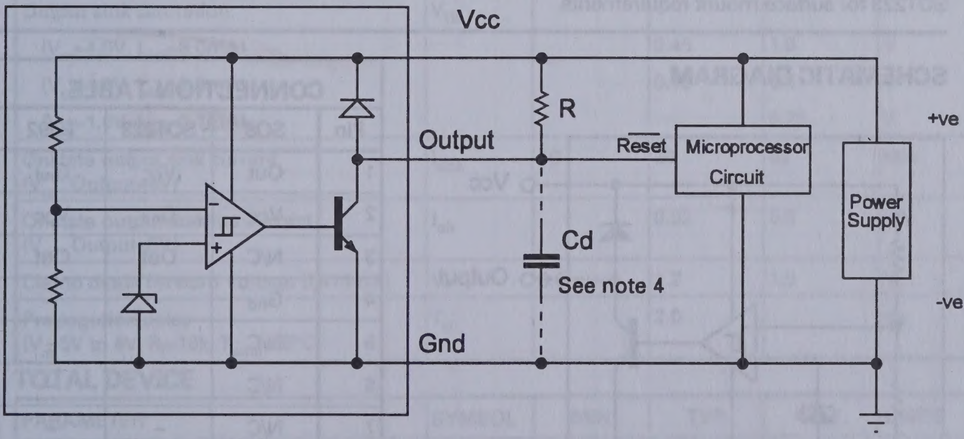


Threshold Voltage vs. Temperature

TIMING DIAGRAM


Vcc
Threshold Voltage
1 V
Output
Output Undefined
Output Undefined

APPLICATION CIRCUIT


Vcc
Output
Gnd
R
Cd
See note 4
Reset
Microprocessor Circuit
Power Supply
+ve
-ve

Note 4: A time delayed reset can be accomplished with the additional Cd.

$$T_{DY} = RCd \ln\left(\frac{1}{1-\frac{V_{TH(mpu)}}{V_{in}}}\right)$$

T_{DY} =Time (Seconds)
V_{TH} =Microprocessor Resistance Threshold(Ohms)
V_{in} =Power Supply Voltage

SUPPLY VOLTAGE MONITOR

ZM33164

ISSUE 2 – NOVEMBER 1995

DEVICE DESCRIPTION

The ZM33164 is a three terminal under voltage monitor circuit for use in microprocessor systems. The threshold voltage of the device has been set to 4.3volts making it ideal for 5 volt circuits.

Included in the device is a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The ZM33164 features on open collector output capable of sinking at least l0mA which only requires a single external resistor to interface to following circuits.

Operation of the device is guaranteed from one volt upwards, from this level to the device threshold voltage the output is held low providing a power on reset function. Should the supply voltage, once established, at any time drop below the threshold level then the output again will pull low.

The device is available in a TO92 package for through hole applications as well as SO8 and SOT223 for surface mount requirements.

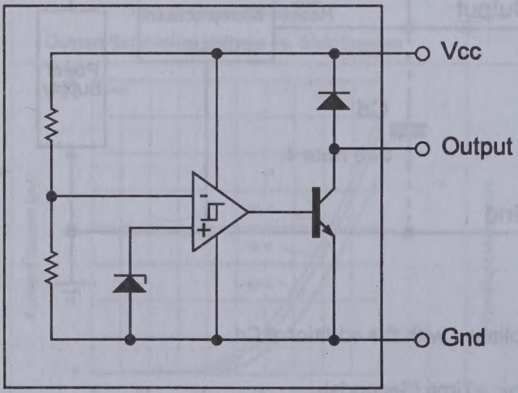
FEATURES

- SO8, SOT223 and TO92 packages
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.3 volt threshold for 5 volt logic
- 60mV hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	Out	Vcc	Gnd
2	Vcc	Gnd	Vcc
3	N/C	Out	Out
4	Gnd	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	N/C	–	–
Pack	N8	G	C

see Diagrams Page 3 - 3

ABSOLUTE MAXIMUM RATING

Input Supply Voltage	-1 to 12V
Offstate Output Voltage	12V
Onstate Output Sink Current(Note 1)	Internally limited
Clamp diode Forward Current(Note 1)	100mA
Operating junction temperature	150°C
Operating Temperature	-40 to 85°C
Storage Temperature	-65 to 150°C

Power Dissipation	
TO92	780mW
SOT223	2W(Note 2)
SO8	780mW(Note 2)

TEST CONDITIONS
(T_{amb}=25°C for typical values, T_{amb}=-40 to 85°C for min/max values (Note3))

COMPARATOR

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Threshold Voltage High state output (Vcc increasing)	V_{IH}	4.15	4.33	4.45	V
Threshold Voltage Low state output (Vcc decreasing)	V_{IL}	4.15	4.27	4.45	V
Hysteresis	V_H	0.02	0.06		V

OUTPUT

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Output sink saturation:	V_{OL}				
(V_{cc}=4.0V, I_{sink}=8.0mA)			0.46	1.0	V
(V_{cc}=4.0V, I_{sink}=2.0mA)			0.15	0.4	V
(V_{cc}=1.0V, I_{sink}=0.1mA)				0.25	V
Onstate output sink current (V_{cc}, Output=4V)	I_{sink}	10	20	50	mA
Offstate output leakage current (V_{cc}, Output=5V)	I_{oh}		0.02	0.5	µA
Clamp diode forward voltage (I_f=10mA)	V_f	0.6	1.2	1.5	V
Propagation delay (V_{in} 5V to 4V, R_l=10k, T_{amb}=25°C)	T_d		2.0		µs

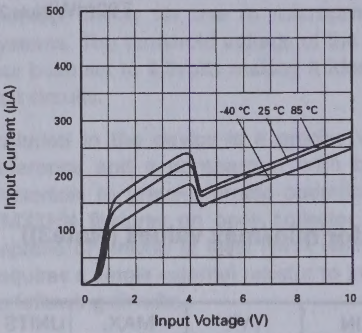
TOTAL DEVICE

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Operating input voltage range	V_{cc}	1.0 to 10			V
Quiescent input current (V_{cc}=5V)	I_q		175	260	µA

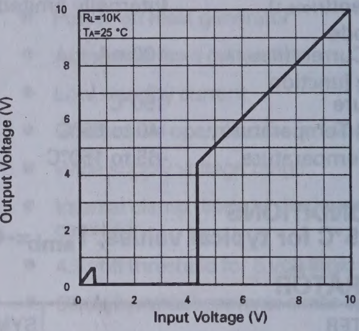
Note:

1. Maximum package power dissipation must be observed
2. Maximum power dissipation, for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.
3. Low duty cycle pulse techniques are used during test to maintain junction temperatures as close to ambient as possible

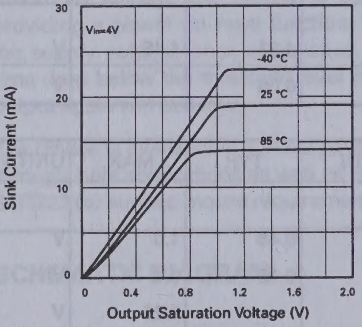
TYPICAL CHARACTERISTICS



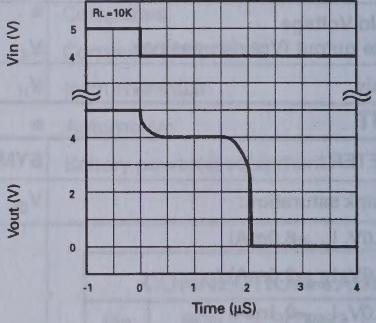
Input Current vs. Input Voltage



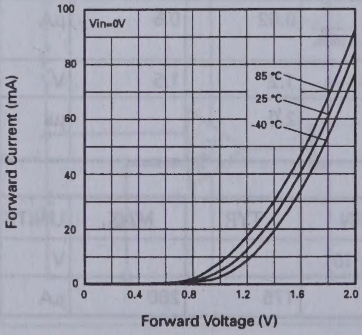
Output Voltage vs. Input Voltage



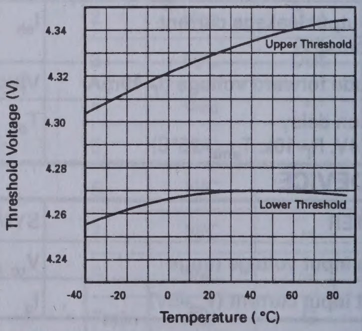
Output Saturation Voltage vs. Sink Current



Reset Delay Time

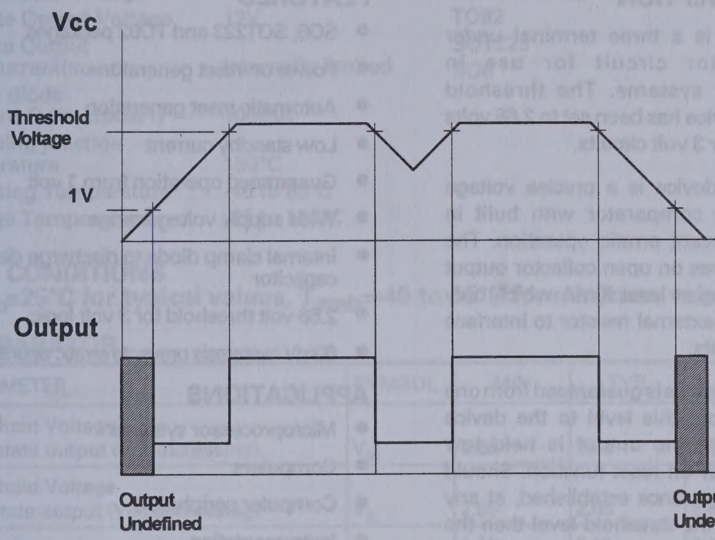


Clamp Diode Forward Current vs. Voltage

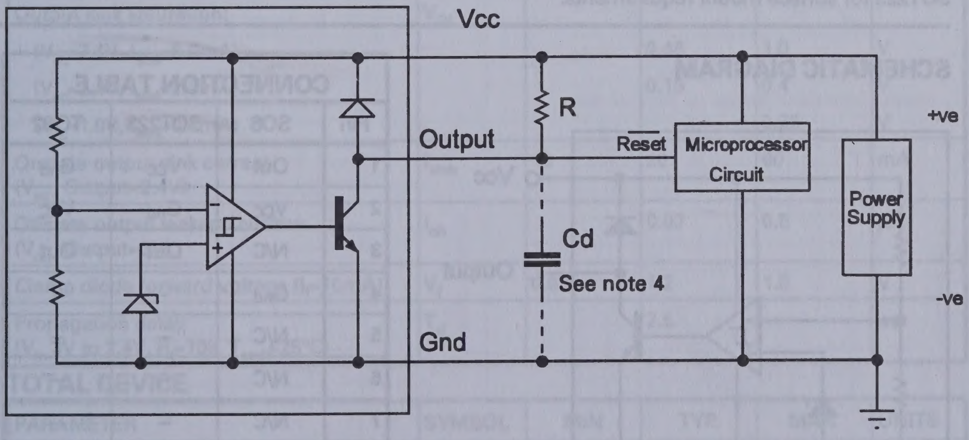


Threshold Voltage vs. Temperature

TIMING DIAGRAM


Vcc
Threshold Voltage
1 V
Output
Output Undefined
Output Undefined

APPLICATION CIRCUIT


Vcc
Output
Gnd
R
Reset
Microprocessor Circuit
Cd
See note 4
+ve
Power Supply
-ve

Note 4: A time delayed reset can be accomplished with the additional Cd.

$$T_{DY} = RCd \ln\left(\frac{1}{1-\frac{V_{TH(mpu)}}{V_{in}}}\right)$$

T_{DY} =Time (Seconds)
V_{TH} =Microprocessor Resistance Threshold(Ohms)
V_{in} =Power Supply Voltage

SUPPLY VOLTAGE MONITOR

ZM33164-3

ISSUE 2 – NOVEMBER 1995

DEVICE DESCRIPTION

The ZM33164-3 is a three terminal under voltage monitor circuit for use in microprocessor systems. The threshold voltage of the device has been set to 2.68 volts making it ideal for 3 volt circuits.

Included in the device is a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The ZM33164-3 features on open collector output capable of sinking at least l0mA which only requires a single external resistor to interface to following circuits.

Operation of the device is guaranteed from one volt upwards, from this level to the device threshold voltage the output is held low providing a power on reset function. Should the supply voltage, once established, at any time drop below the threshold level then the output again will pull low.

The device is available in a TO92 package for through hole applications as well as SO8 and SOT223 for surface mount requirements.

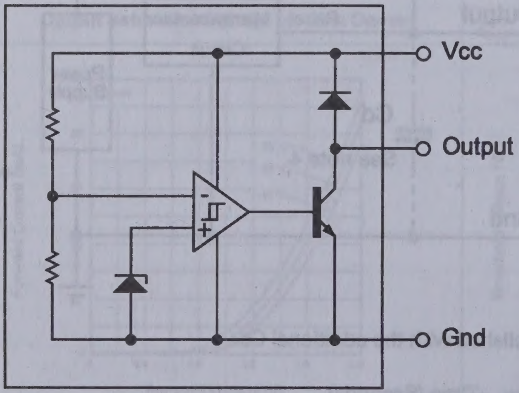
FEATURES

- SO8, SOT223 and TO92 packages
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 2.68 volt threshold for 3 volt logic
- 60mV hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



CONNECTION TABLE

Pin	SO8	SOT223	TO92
1	Out	Vcc	Gnd
2	Vcc	Gnd	Vcc
3	N/C	Out	Out
4	Gnd	-	–
5	N/C	–	–
6	N/C	–	–
7	N/C	–	–
8	N/C	–	–
Pack	N8	G	C

see Diagrams Page 3 - 3

ABSOLUTE MAXIMUM RATING

Input Supply Voltage	-1 to 12V
Offstate Output Voltage	12V
Onstate Output Sink Current(Note 1)	Internally limited
Clamp diode Forward Current(Note 1)	100mA
Operating junction temperature	150°C
Operating Temperature	-40 to 85°C
Storage Temperature	-65 to 150°C

Power Dissipation	
TO92	780mW
SOT223	2W(Note 2)
SO8	780mW(Note 2)

TEST CONDITIONS
(T_{amb}=25°C for typical values, T_{amb}=-40 to 85°C for min/max values (Note3))

COMPARATOR

PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Threshold Voltage High state output (Vcc increasing)	V_{IH}	2.55	2.71	2.8	V
Threshold Voltage Low state output (Vcc decreasing)	V_{IL}	2.55	2.65	2.8	V
Hysteresis	V_H	0.03	0.06	0.15	V

OUTPUT

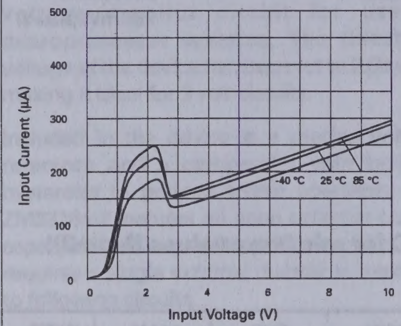
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Output sink saturation:	V_{OL}				
(V_{cc}=2.4V, I_{sink}=8.0mA)			0.46	1.0	V
(V_{cc}=2.4V, I_{sink}=2.0mA)			0.15	0.4	V
(V_{cc}=1.0V, I_{sink}=0.1mA)				0.25	V
Onstate output sink current (V_{cc}, Output=2.4V)	I_{sink}	10	20	60	mA
Offstate output leakage current (V_{cc}, Output=3V)	I_{oh}		0.02	0.5	µA
Clamp diode forward voltage (I_f=10mA)	V_f	0.6	1.2	1.5	V
Propagation delay (V_{in} 3V to 2.4V, R_l=10k, T_{amb}=25°C)	T_d		2.5		µs

TOTAL DEVICE

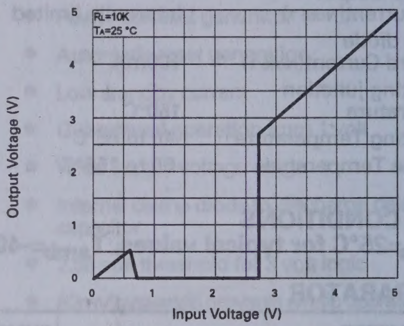
PARAMETER	SYMBOL	MIN	TYP.	MAX.	UNITS
Operating input voltage range	V_{cc}	1.0 to 10			V
Quiescent input current (V_{cc}=3V)	I_q		125	190	µA

Note:
1. Maximum package power dissipation must be observed
2. Maximum power dissipation, for the SOT223 and SO8 packages, is calculated assuming that the device is mounted on a PCB measuring 2 inches square.
3. Low duty cycle pulse techniques are used during test to maintain junction temperatures as close to ambient as possible

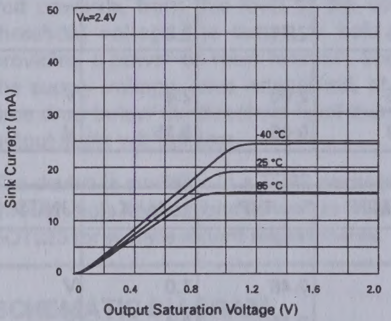
TYPICAL CHARACTERISTICS



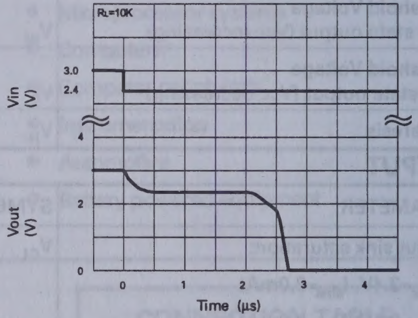
Input Current vs. Input Voltage



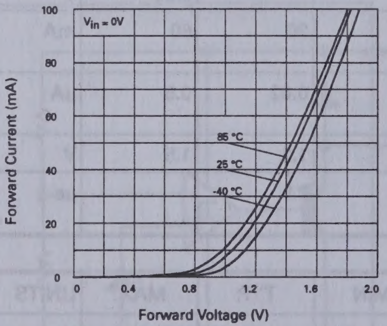
Output Voltage vs. Input Voltage



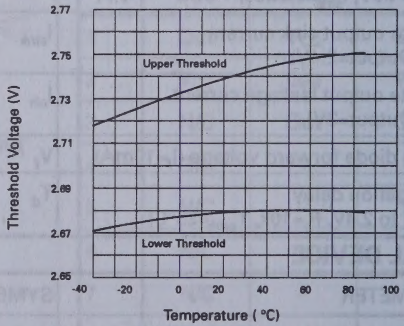
Output Saturation Voltage vs. Sink Current



Reset Delay Time

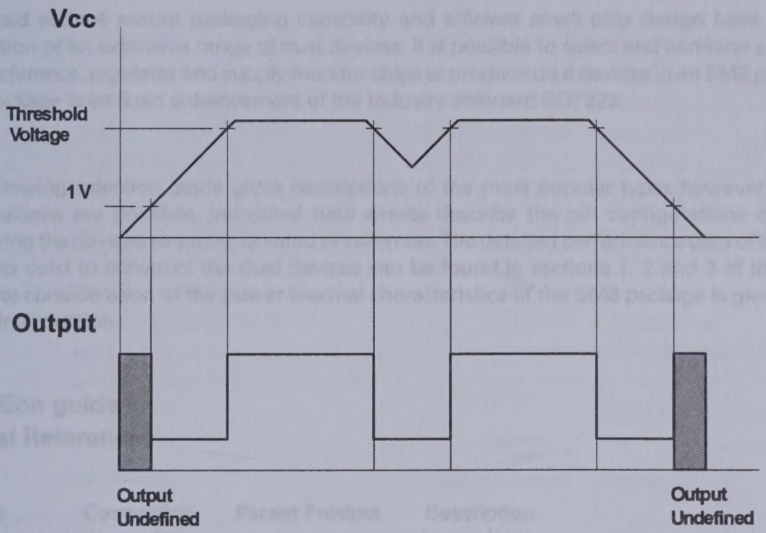


Clamp Diode Forward Current vs. Voltage

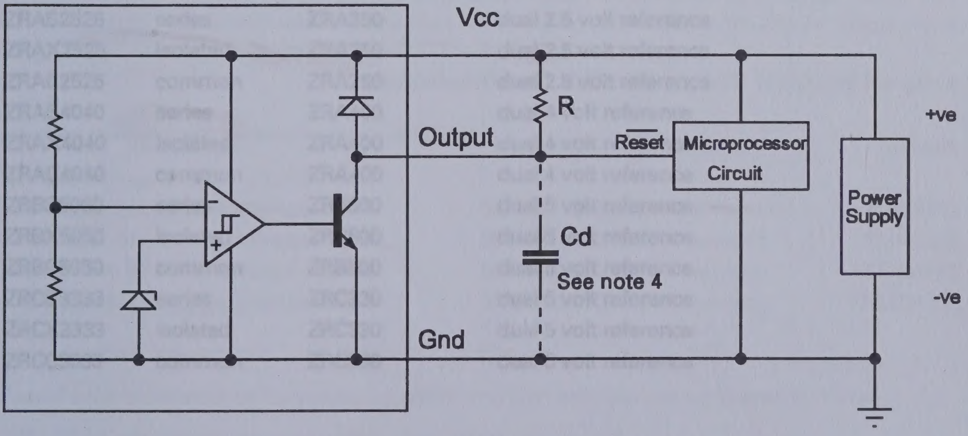


Threshold Voltage vs. Temperature

TIMING DIAGRAM


Vcc
Threshold Voltage
1 V
Output
Output Undefined
Output Undefined

APPLICATION CIRCUIT


Vcc
R
Output
Reset
Microprocessor Circuit
+ve
Power Supply
Cd
See note 4
-ve
Gnd

Note 4: A time delayed reset can be accomplished with the additional Cd.

$$T_{DY} = RCd \ln\left(\frac{1}{1-\frac{V_{TH(mpu)}}{V_{in}}}\right)$$

T_{DY} =Time (Seconds)
V_{TH} =Microprocessor Resistance Threshold(Ohms)
V_{in} =Power Supply Voltage

Section 4
Dual Devices

Advanced surface mount packaging capability and efficient small chip design have enabled the production of an extensive range of dual devices. It is possible to select and combine almost any of Zetex reference, regulator and supply monitor chips to produce dual devices in an SM8 package. The SM8 package is an 8 pin enhancement of the industry standard SOT223.

The following selection guide gives descriptions of the most popular types however many more combinations are possible. Individual data sheets describe the pin configurations of the device identifying the devices as series, isolated or common. The detailed performance data of the individual products used to construct the dual devices can be found in sections 1, 2 and 3 of this databook. Separate consideration of the power thermal characteristics of the SM8 package is given at the end of this introduction.

Selection guide
1. Dual References

Part No	Connection	Parent Product	Description
ZRAS1212	series	ZRA125	dual 1.25 volt reference
ZRAX1212	isolated	ZRA125	dual 1.25 volt reference
ZRAC1212	common	ZRA125	dual 1.25 volt reference
ZRAS2525	series	ZRA250	dual 2.5 volt reference
ZRAX2525	isolated	ZRA250	dual 2.5 volt reference
ZRAC2525	common	ZRA250	dual 2.5 volt reference
ZRAS4040	series	ZRA400	dual 4 volt reference
ZRAX4040	isolated	ZRA400	dual 4 volt reference
ZRAC4040	common	ZRA400	dual 4 volt reference
ZRBS5050	series	ZRB500	dual 5 volt reference
ZRBX5050	isolated	ZRB500	dual 5 volt reference
ZRBC5050	common	ZRB500	dual 5 volt reference
ZRCS3333	series	ZRC330	dual 5 volt reference
ZRCX3333	isolated	ZRC330	dual 5 volt reference
ZRCC3333	common	ZRC330	dual 5 volt reference

Selection guide (continued)

2. Dual Regulators

Part No	Connection	Parent Product	Description
ZSXD5033	isolated	ZSR500, ZSR330	5 and 3.3 volt regulator
ZSCD5033	common	ZSR500, ZSR330	5 and 3.3 volt regulator
ZSXD5030	isolated	ZSR500, ZSR330	5 and 3 volt regulator
ZSCD5030	common	ZSR500, ZSR330	5 and 3 volt regulator
ZRDX431	isolated	ZR431	dual programmable regulator
ZRDC431	common	ZR431	dual programmable regulator
ZRDX2431*	isolated	ZR2431	dual programmable regulator
ZRDC2431*	common	ZR2431	dual programmable regulator

* advanced information

3. Dual Supply Monitors

Part No	Connection	Parent Product	Description
ZSMD5633	common	ZSM560, ZSM330	4.6 and 3.08 volt threshold monitor
ZSMD5630	common	ZSM560, ZSM300	4.6 and 2.63 volt threshold monitor
ZSMD5333	common	ZSM530, ZSM330	4.3 and 3.08 volt threshold monitor
ZSMD5330	common	ZSM530, ZSM300	4.3 and 2.63 volt threshold monitor

4. Dual Regulator Supply Monitor Combinations

Part No	Connection	Parent Product	Description
ZRSM5060	common	ZSR500, ZSM560	5 volt regulator and 4.6 volt monitor
ZRSM5030	common	ZSR500, ZSM530	5 volt regulator and 4.3 volt monitor
ZRSM3333	common	ZSR330, ZSM330	3.3 volt regulator and 3.08 volt monitor
ZRSM3030	common	ZSR300, ZSM300	3 volt regulator and 2.63 volt monitor

Dual Devices - Thermal Characteristics

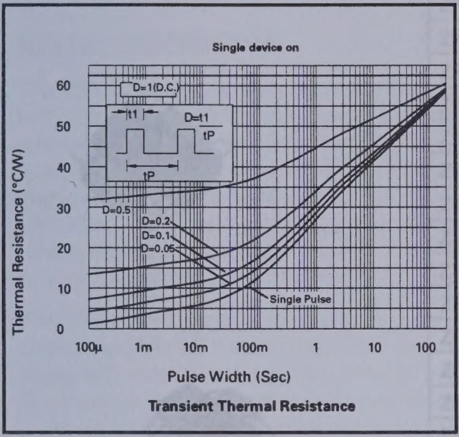


Figure 1

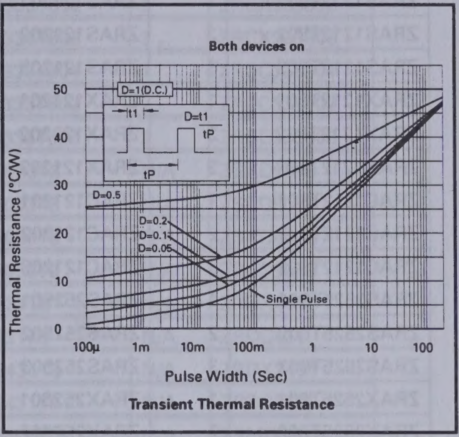


Figure 2

Dual Devices - Thermal Characteristics

The above graphs demonstrate the thermal resistance of the dual device SM8 package when mounted on a 2" x 2" FR4 PCB. Figure 1 shows the data for the case of one device powered and Figure 2 for when both devices are powered evenly. Given the intended power dissipation and the maximum ambient temperature, these graphs can be used to calculate the maximum junction temperature of a chip mounted in the dual device SM8 package. This should not exceed the maximum ratings given on the parent data sheets of the chips used in the dual devices.

Junction temperature can be calculated as follows:-

$T_j = T_{amb} + (P_{diss} \times T_hR)$ (°C/W)

Where:-

T_j = Junction temperature

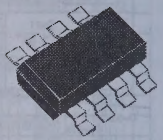
T_{amb} = Ambient temperature

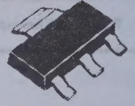
P_{diss} = Power dissipation or Total power dissipation (when both devices are powered evenly)

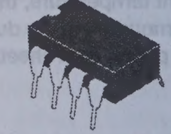
T_hR = Transient thermal resistance (taken from the above graphs)

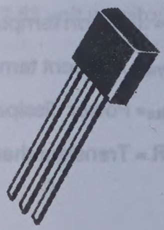
Dual Devices Ordering Information

Part Number	Tol %	Part Mark
ZRAS1212T801	1	ZRAS121201
ZRAS1212T802	2	ZRAS121202
ZRAS1212T803	3	ZRAS121203
ZRAX1212T801	1	ZRAX121201
ZRAX1212T802	2	ZRAX121202
ZRAX1212T803	3	ZRAX121203
ZRAC1212T801	1	ZRAC121201
ZRAC1212T802	2	ZRAC121202
ZRAC1212T803	3	ZRAC121203
ZRAS2525T801	1	ZRAS252501
ZRAS2525T802	2	ZRAS252502
ZRAS2525T803	3	ZRAS252503
ZRAX2525T801	1	ZRAX252501
ZRAX2525T802	2	ZRAX252502
ZRAX2525T803	3	ZRAX252503
ZRAC2525T801	1	ZRAC252501
ZRAC2525T802	2	ZRAC252502
ZRAC2525T803	3	ZRAC252503
ZRAS4040T801	1	ZRAS404001
ZRAS4040T802	2	ZRAS404002
ZRAS4040T803	3	ZRAS404003
ZRAX4040T801	1	ZRAX404001
ZRAX4040T802	2	ZRAX404002
ZRAX4040T803	3	ZRAX404003
ZRAC4040T801	1	ZRAC404001
ZRAC4040T802	2	ZRAC404002
ZRAC4040T803	3	ZRAC404003
ZRBS5050T801	1	ZRBS505001
ZRBS5050T802	2	ZRBS505002
ZRBS5050T803	3	ZRBS505003
ZRBX5050T801	1	ZRBX505001
ZRBX5050T802	2	ZRBX505002
ZRBX5050T803	3	ZRBX505003
ZRBC5050T801	1	ZRBC505001
ZRBC5050T802	2	ZRBC505002
ZRBC5050T803	3	ZRBC505003
ZRCS3333T801	1	ZRCS333301
ZRCS3333T802	2	ZRCS333302
ZRCS3333T803	3	ZRCS333303
ZRCX3333T801	1	ZRCX333301

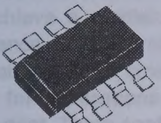


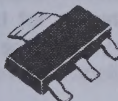




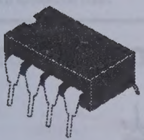


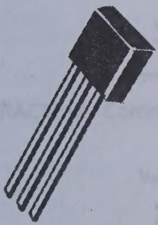
Dual Devices Ordering Information(continued)





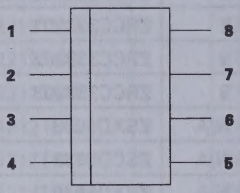
Part Number	Tol%	Part Mark
ZRCX3333T802	2	ZRCX333302
ZRCX3333T803	3	ZRCX333303
ZRCC3333T801	1	ZRCC333301
ZRCC3333T802	2	ZRCC333302
ZRCC3333T803	3	ZRCC333303
ZSXD5033T8	N/A	ZSXD5033
ZSCD5033T8	N/A	ZSCD5033
ZSXD5030T8	N/A	ZSXD5030
ZSCD5030T8	N/A	ZSCD5030
ZRDX431T8	N/A	ZRDX431
ZRDC431T8	N/A	ZRDC431
ZRDX2431T8	N/A	ZRDX2431
ZRDC2431T8	N/A	ZRDC2431
ZSMD5633T8	N/A	ZSMD5633
ZSMD5630T8	N/A	ZSMD5630
ZSMD5333T8	N/A	ZSMD5333
ZSMD5330T8	N/A	ZSMD5330
ZRSM5060T8	N/A	ZRSM5060
ZRSM5030T8	N/A	ZRSM5030
ZRSM3333T8	N/A	ZRSM3333
ZRSM3030T8	N/A	ZRSM3030





Dual Devices Connection Diagram

SM8 Package Suffix – T8



Top View

DUAL PRECISION 1.25 VOLT MICROPOWER VOLTAGE REFERENCE

ZRAC1212
ZRAS1212
ZRAX1212

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRA¤1212 uses a bandgap circuit design to achieve a precision micropower voltage reference of 1.25 volts. The dual device is available in Zetex small outline SM8 package, ideal for applications where space saving is important. Three configurations are available -series, common and isolated - as represented in the schematic diagrams below.

The ZRA¤1212 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRA¤1212 is recommended for operation between 50µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

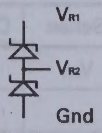
FEATURES

- Small outline SM8 package
- Three device configurations
- No stabilising capacitor required
- Typical T_C 30ppm/°C
- Typical slope resistance 0.65Ω
- ± 3%,2% and 1% tolerance
- Industrial temperature range
- Operating current 50µA to 5mA
- Transient response, stable in less than 10µs
- Optional extended current range

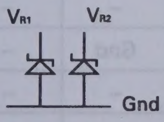
APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Data acquisition systems.
- Precision power supplies.
- Test equipment.

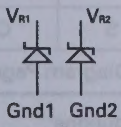
SCHEMATIC DIAGRAMS



ZRAS1212 - Series Connected



ZRAC1212 - Common Connected



ZRAX1212 - Isolated

CONNECTION TABLE

Pin	Series	Common	Isolated
1	V_{R1}	V_{R1}	V_{R1}
2	–	–	–
3	V_{R2}	V_{R2}	V_{R2}
4	–	–	–
5	Gnd	–	Gnd2
6	–	–	–
7	–	Gnd	Gnd1
8	–	–	–
Configuration	S	C	X
see Diagram Page 4 - 6			

¤ = connection options

DUAL PRECISION 2.5 VOLT MICROPOWER VOLTAGE REFERENCE

ZRAC2525
ZRAS2525
ZRAX2525

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRA¤2525 uses a bandgap circuit design to achieve a precision micropower voltage reference of 2.5 volts. The dual device is available in Zetex small outline SM8 package, ideal for applications where space saving is important. Three configurations are available -series, common and isolated - as represented in the schematic diagrams below.

The ZRA¤2525 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRA¤2525 is recommended for operation between 50µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

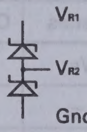
FEATURES

- Small outline SM8 package
- Three device configurations
- No stabilising capacitor required
- Typical T_C 30ppm/°C
- Typical slope resistance 0.4Ω
- ± 3%,2% and 1% tolerance
- Industrial temperature range
- Operating current 50µA to 5mA
- Transient response, stable in less than 10µs
- Optional extended current range

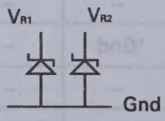
APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.

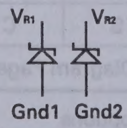
SCHEMATIC DIAGRAMS



ZRAS2525 - Series Connected



ZRAC2525 - Common Connected



ZRAX2525 - Isolated

CONNECTION TABLE

Pin	Series	Common	Isolated
1	V_{R1}	V_{R1}	V_{R1}
2	–	–	–
3	V_{R2}	V_{R2}	V_{R2}
4	–	–	–
5	Gnd	–	Gnd2
6	–	–	–
7	–	Gnd	Gnd1
8	–	–	–
Configuration	S	C	X
see Diagram Page 4 - 6			

¤ = connection options

DUAL PRECISION 4.1 VOLT MICROPOWER VOLTAGE REFERENCE

ZRAC4040
ZRAS4040
ZRAX4040

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRA¤4040 uses a bandgap circuit design to achieve a precision micropower voltage reference of 4.096 volts. The dual device is available in Zetex small outline SM8 package, ideal for applications where space saving is important. Three configurations are available -series, common and isolated - as represented in the schematic diagrams below.

The ZRA¤4040 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRA¤4040 is recommended for operation between 50µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

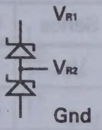
FEATURES

- Small outline SM8 package
- Three device configurations
- No stabilising capacitor required
- Typical T_C 15ppm/°C
- Typical slope resistance 0.55Ω
- ± 3%,2% and 1% tolerance
- Industrial temperature range
- Operating current 50µA to 5mA

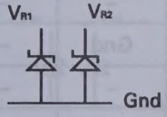
APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.
- Crystal oscillators.

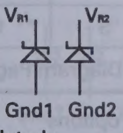
SCHEMATIC DIAGRAMS



ZRAS4040 - Series Connected



ZRAC4040 - Common Connected



ZRAX4040 - Isolated

CONNECTION TABLE

Pin	Series	Common	Isolated
1	V_{R1}	V_{R1}	V_{R1}
2	–	–	–
3	V_{R2}	V_{R2}	V_{R2}
4	–	–	–
5	Gnd	–	Gnd2
6	–	–	–
7	–	Gnd	Gnd1
8	–	–	–
Configuration	S	C	X
see Diagram Page 4 - 6			

¤ = connection options

DUAL PRECISION 5.0 VOLT MICROPOWER VOLTAGE REFERENCE

ZRBC5050
ZRBS5050
ZRBX5050

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRB¤5050 uses a bandgap circuit design to achieve a precision micropower voltage reference of 5.0 volts. The dual device is available in Zetex small outline SM8 package, ideal for applications where space saving is important. Three configurations are available -series, common and isolated - as represented in the schematic diagrams below.

The ZRB¤5050 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRB¤5050 is recommended for operation between 50µA and 15mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

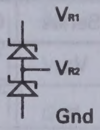
FEATURES

- Small outline SM8 package
- Three device configurations
- No stabilising capacitor required
- Typical Tc 15ppm/°C
- Typical slope resistance 0.33Ω
- ± 3%,2% and 1% tolerance
- Industrial temperature range
- Operating current 50µA to 5mA
- Transient response, stable in less than 10µs

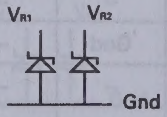
APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.

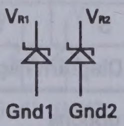
SCHEMATIC DIAGRAMS



ZRBS5050 - Series Connected



ZRBC5050 - Common Connected



ZRBX5050 - Isolated

CONNECTION TABLE

Pin	Series	Common	Isolated
1	V_{R1}	V_{R1}	V_{R1}
2	–	–	–
3	V_{R2}	V_{R2}	V_{R2}
4	–	–	–
5	Gnd	–	Gnd2
6	–	–	–
7	–	Gnd	Gnd1
8	–	–	–
Configuration	S	C	X
see Diagram Page 4 - 6			

¤ = connection options

DUAL PRECISION 3.3 VOLT MICROPOWER VOLTAGE REFERENCE

ZRCC3333
ZRCS3333
ZRCX3333

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRC¤3333 uses a bandgap circuit design to achieve a precision micropower voltage reference of 3.3 volts. The dual device is available in Zetex small outline SM8 package, ideal for applications where space saving is important. Three configurations are available -series, common and isolated - as represented in the schematic diagrams below.

The ZRC¤3333 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRC¤3333 is recommended for operation between 20µA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to a suggested absolute maximum of 25mA however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

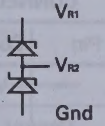
FEATURES

- Small outline SM8 package
- Three device configurations
- No stabilising capacitor required
- Low knee current, 15µA typical
- Typical slope resistance 0.6Ω
- ± 3%,2% and 1% tolerance
- Industrial temperature range
- Operating current 20µA to 5mA

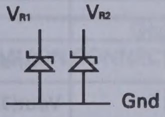
APPLICATIONS

- Battery powered and portable equipment.
- Metering and measurement systems.
- Instrumentation.
- Test equipment.
- Data acquisition systems.
- Precision power supplies.
- Crystal oscillators.

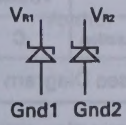
SCHEMATIC DIAGRAMS



ZRCS3333 - Series Connected



ZRCC3333 - Common Connected



ZRCX3333 - Isolated

CONNECTION TABLE

Pin	Series	Common	Isolated
1	V_{R1}	V_{R1}	V_{R1}
2	–	–	–
3	V_{R2}	V_{R2}	V_{R2}
4	–	–	–
5	Gnd	–	Gnd2
6	–	–	–
7	–	Gnd	Gnd1
8	–	–	–
Configuration	S	C	X
see Diagram Page 4 - 6			

¤ = connection options

DUAL FIXED POSITIVE 5 AND 3.3 VOLT LOCAL VOLTAGE REGULATOR

ZSCD5033
ZSXD5033

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZS¤D5033 dual fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices almost impossible to destroy.

The devices are available in Zetex small outline SM8 package, ideal for applications where space saving is important. Two configurations are available - common and isolated - as represented in the schematic diagrams below.

The devices feature output voltages of 5 and 3.3 volts each capable of delivering up to 200mA. The SM8 package allows up to 2.25W power dissipation for each regulator.

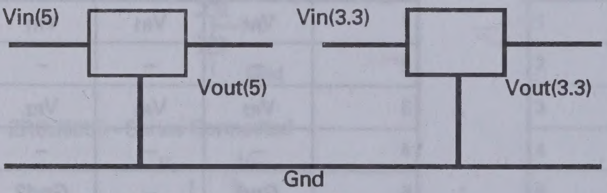
The devices are suited to local voltage regulation applications, where problems could be encountered with distributed single source regulation, as well as more general voltage regulation applications.

The ZS¤D5033 devices show performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350μA. Output voltage change with input voltage and load current is much lower than competitive devices. The ZS¤D5033 devices are completely stable with no external components. The devices will shut down under thermal overload conditions but as the device cools, regulation will restart until thermal overload reoccurs.

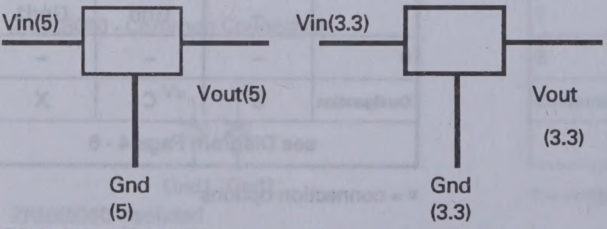
FEATURES

- Small outline SM8 package
- Two device configurations
- 5V and 3.3V output
- Output current up to 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125 °C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit
- 2.25W per device

SCHEMATIC DIAGRAMS



ZSCD5030 - COMMON CONNECTED



ZSXD5030 - ISOLATED

CONNECTION TABLE

Pin	Common	Isolated
1	Vin(5)	Vin(5)
2	-	-
3	Vin(3.3)	Vin(3.3)
4	-	-
5	Gnd	Gnd(3.3)
6	Vout(3.3)	Vout(3.3)
7	-	Gnd(5)
8	Vout(5)	Vout(5)
Configuration	C	X
see Diagram Page 4 - 6		

¤ = connection options

DUAL FIXED POSITIVE 5 AND 3 VOLT LOCAL VOLTAGE REGULATOR

ZSCD5030
ZSXD5030

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZS¤D5030 dual fixed positive voltage regulators feature internal circuit current limit and thermal shutdown making the devices almost impossible to destroy.

The devices are available in Zetex small outline SM8 package, ideal for applications where space saving is important. Two configurations are available - common and isolated - as represented in the schematic diagrams below.

The devices feature output voltages of 5 and 3 volts each capable of delivering up to 200mA. The SM8 package allows up to 2.25W power dissipation for each regulator.

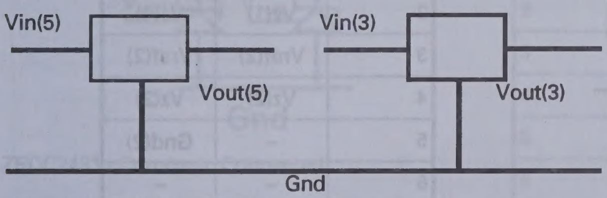
The devices are suited to local voltage regulation applications, where problems could be encountered with distributed single source regulation, as well as more general voltage regulation applications.

The ZS¤D5030 devices show performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Output voltage change with input voltage and load current is much lower than competitive devices. The ZS¤D5030 devices are completely stable with no external components. The devices will shut down under thermal overload conditions but as the device cools, regulation will restart until thermal overload reoccurs.

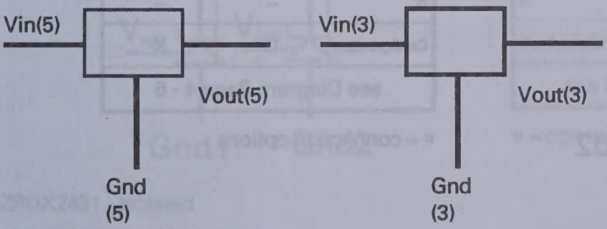
FEATURES

- Small outline SM8 package
- Two device configurations
- 5V and 3V output
- Output current up to 200mA
- Tight initial tolerance
- Low quiescent current
- -55 to 125 °C temperature range
- No external components
- Internal thermal shutdown
- Internal short circuit current limit
- 2.25W per device

SCHEMATIC DIAGRAMS



ZSCD5030 - COMMON CONNECTED



ZSXD5030 - ISOLATED

CONNECTION TABLE

Pin	Common	Isolated
1	Vin(5)	Vin(5)
2	-	-
3	Vin(3)	Vin(3)
4	-	-
5	Gnd	Gnd(3)
6	Vout(3)	Vout(3)
7	-	Gnd(5)
8	Vout(5)	Vout(5)
Configuration	C	X
see Diagram Page 4 - 6		

¤ = connection options

DUAL ADJUSTABLE PRECISION ZENER SHUNT REGULATOR

ZRDC431
ZRDX431

ISSUE 1 – NOVEMBER 1995

DEVICE DESCRIPTION

The ZRD¤431 is a dual three terminal adjustable shunt regulator offering excellent temperature stability and output current handling capability up to 100mA. The output voltage may be set to any chosen voltage between 2.5 and 20 volts by selection of two external divider resistors.

The devices are available in Zetex small outline SM8 package, ideal for applications where space saving is important. Two configurations are available - common and isolated - as represented in the schematic diagrams below.

The devices can be used as a replacement for zener diodes in many applications requiring an improvement in zener performance.

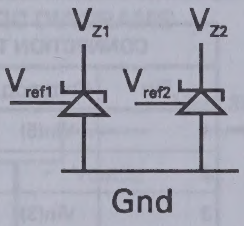
FEATURES

- Surface mount SM8 package
- Two device configurations
- Programmable Output voltage
- Average temperature coefficient 50 ppm/°C
- Temperature compensated for operation over the full temperature range
- 50µA to 100mA current sink capability
- Low output noise

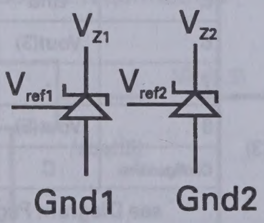
APPLICATIONS

- Shunt regulator
- Series regulator
- Voltage monitor
- Over voltage/ under voltage protection
- Switch mode power supplies

SCHEMATIC DIAGRAMS



ZRDC431 - Common Connected



ZRDX431 - Isolated

CONNECTION TABLE

Pin	Common	Isolated
1	Vref(1)	Vref(1)
2	Vz(1)	Vz(1)
3	Vref(2)	Vref(2)
4	Vz(2)	Vz(2)
5	–	Gnd(2)
6	–	–
7	Gnd	Gnd(1)
8	–	–
Configuration	C	X
see Diagram Page 4 - 6		

¤ = connection options

DUAL ADJUSTABLE PRECISION ZENER SHUNT REGULATOR

ZRDC2431
ZRDX2431

ADVANCED INFORMATION

DEVICE DESCRIPTION

The ZRD¤2431 is a dual three terminal adjustable shunt regulator offering excellent temperature stability and output current handling capability up to 100mA. The output voltage may be set to any chosen voltage between 2.5 and 20 volts by selection of two external divider resistors.

The devices are available in Zetex small outline SM8 package, ideal for applications where space saving is important. Two configurations are available - common and isolated - as represented in the schematic diagrams below.

The devices can be used as a replacement for zener diodes in many applications requiring an improvement in zener performance.

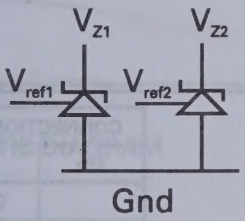
FEATURES

- Surface mount SM8 package
- Two device configurations
- Programmable Output voltage
- Average temperature coefficient 50 ppm/°C
- Temperature compensated for operation over the full temperature range
- 50µA to 100mA current sink capability
- Low output noise

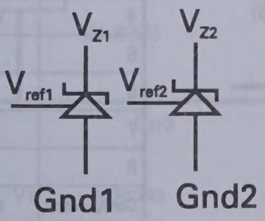
APPLICATIONS

- Shunt regulator
- Series regulator
- Voltage monitor
- Over voltage/ under voltage protection
- Switch mode power supplies

SCHEMATIC DIAGRAMS



ZRDC2431 - Common Connected



ZRDX2431 - Isolated

CONNECTION TABLE

Pin	Common	Isolated
1	Vref(1)	Vref(1)
2	Vz(1)	Vz(1)
3	Vref(2)	Vref(2)
4	Vz(2)	Vz(2)
5	–	Gnd(2)
6	–	–
7	Gnd	Gnd(1)
8	–	–
Configuration	C	X
see Diagram Page 4 - 6		

¤ = connection options

DUAL SUPPLY VOLTAGE MONITOR

ZSMD5633

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZSMD5633 is a dual three terminal under voltage monitor for use in microprocessor systems. The device is designed to monitor both 5 volt and 3.3 volt supplies containing two monitor cicuits with threshold voltages of 4.6 and 3.1 volts respectively.

The devices are available in Zetex small outline SM8 package, ideal for applications where space saving is important.

Each circuit includes a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the ZSMD5633 is guaranteed with supply voltages from one volt upwards. From one volt up to each device threshold level the output is held low providing a power on reset function. Should the established supply voltage drop below the threshold level at any time, then the output again will pull low.

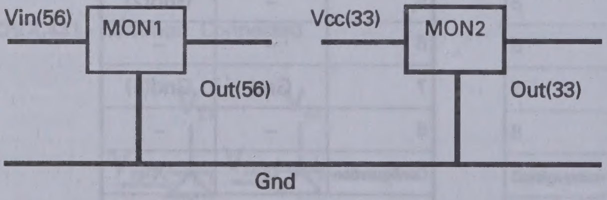
FEATURES

- Small outline SM8 package
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.6 volt threshold for 5 volt logic
- 3.1 volt threshold for 3.3 volt logic
- 20mV monitor hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



MON1 V_T = 4.6volts

MON2 V_T = 3.1volts

CONNECTION TABLE	
Pin	
1	Out(56)
2	Vcc(56)
3	Out(33)
4	Vcc(33)
5	Gnd
6	-
7	-
8	-
Configuration	Common
see Diagram Page 4 - 6	

DUAL SUPPLY VOLTAGE MONITOR

ZSMD5630

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZSMD5630 is a dual three terminal under voltage monitor for use in microprocessor systems. The device is designed to monitor both 5 volt and 3 volt supplies containing two monitor cicuits with threshold voltages of 4.6 and 2.63 volts respectively.

The devices are available in Zetex small outline SM8 package, ideal for applications where space saving is important.

Each circuit includes a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the ZSMD5630 is guaranteed with supply voltages from one volt upwards. From one volt up to each device threshold level the output is held low providing a power on reset function. Should the established supply voltage drop below the threshold level at any time, then the output again will pull low.

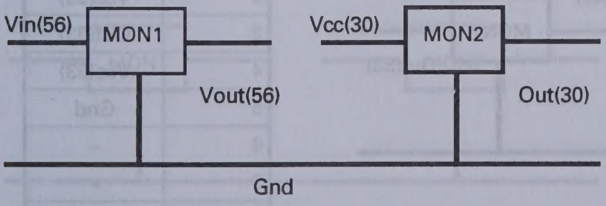
FEATURES

- Small outline SM8 package
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.6 volt threshold for 5 volt logic
- 2.63 volt threshold for 3 volt logic
- 20mV monitor hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



MON1 V_T = 4.6volts

MON2 V_T = 2.63volts

CONNECTION TABLE	
Pin	
1	Out(56)
2	Vcc(56)
3	Out(30)
4	Vcc(30)
5	Gnd
6	–
7	–
8	-
Configuration	**Common**
see Diagram Page 4 - 6	

DUAL SUPPLY VOLTAGE MONITOR

ZSMD5333

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZSMD5333 is a dual three terminal under voltage monitor for use in microprocessor systems. The device is designed to monitor both 5 volt and 3.3 volt supplies containing two monitor cicuits with threshold voltages of 4.3 and 3.1 volts respectively.

The devices are available in Zetex small outline SM8 package, ideal for applications where space saving is important.

Each circuit includes a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the ZSMD5333 is guaranteed with supply voltages from one volt upwards. From one volt up to each device threshold level the output is held low providing a power on reset function. Should the established supply voltage drop below the threshold level at any time, then the output again will pull low.

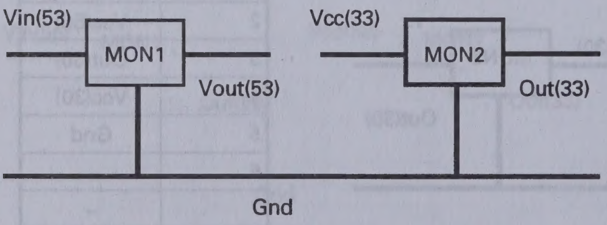
FEATURES

- Small outline SM8 package
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.3 volt threshold for 5 volt logic
- 3.1 volt threshold for 3.3 volt logic
- 20mV monitor hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



MON1 V_T = 4.3volts

MON2 V_T = 3.1volts

CONNECTION TABLE	
Pin	
1	Out(53)
2	Vcc(53)
3	Out(33)
4	Vcc(33)
5	Gnd
6	–
7	–
8	-
Configuration	**Common**
see Diagram Page 4 - 6	

DUAL SUPPLY VOLTAGE MONITOR

ZSMD5330

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZSMD5330 is a dual three terminal under voltage monitor for use in microprocessor systems. The device is designed to monitor both 5 volt and 3 volt supplies containing two monitor cicuits with threshold voltages of 4.3 and 2.63 volts respectively.

The devices are available in Zetex small outline SM8 package, ideal for applications where space saving is important.

Each circuit includes a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the ZSMD5330 is guaranteed with supply voltages from one volt upwards. From one volt up to each device threshold level the output is held low providing a power on reset function. Should the established supply voltage drop below the threshold level at any time, then the output again will pull low.

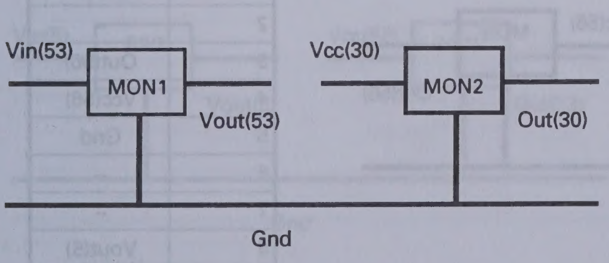
FEATURES

- Small outline SM8 package
- Power on reset generator
- Automatic reset generation
- Low standby current
- Guaranteed operation from 1 volt
- Wide supply voltage range
- Internal clamp diode to discharge delay capacitor
- 4.3 volt threshold for 5 volt logic
- 2.63 volt threshold for 3 volt logic
- 20mV monitor hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



MON1 V_T = 4.3volts

MON2 V_T = 2.63volts

CONNECTION TABLE

Pin	
1	Out(53)
2	Vcc(53)
3	Out(30)
4	Vcc(30)
5	Gnd
6	–
7	–
8	-
Configuration	Common
see Diagram Page 4 - 6	

FIXED LOCAL VOLTAGE REGULATOR AND SUPPLY MONITOR

ZRSM5060

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRSM5060 uses Zetex SM8 package to provide both regulator and supply monitor functions. This small outline surface mount package is ideal for applications where space saving is important.

The regulator section provides a fixed 5 volt positive output supplying load current up to 200mA. The circuit features internal current limit and thermal shutdown which makes the device almost impossible to destroy. The regulator shows performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Line and load regulation is improved compared with alternative devices.

The supply monitor provides a reset threshold of 4.6 volts and so operates as an ideal partner to the 5 volt regulator. The circuit includes a precise voltage reference and a comparator with built in hystresis to prevent erratic operation.The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the supply monitor is guaranteed with supply voltages from one volt upwards. From one volt up to the 4.6 volt threshold level the output is held low providing a power on reset function. Should the established supply voltage drop below the threshold level at any time, then the output will again pull low.

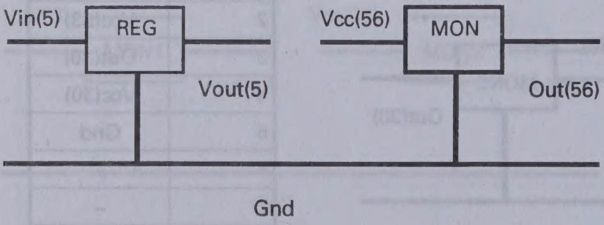
FEATURES

- Small outline SM8 package
- 5 volt, 200mA regulated output
- Low quiescent current
- Regulator internal thermal shutdown and short circuit limit
- Power on reset generation
- Automatic reset generation
- Guaranteed reset from 1 volt
- Wide input supply voltage range
- 4.6 volt monitor threshold for 5 volt logic
- Monitor internal clamp diode to discharge delay capacitor
- 20mV monitor hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



REG – 5 volt regulator

MON – 4.6 volt supply monitor

CONNECTION TABLE	
Pin	
1	Vin(5)
2	–
3	Out(56)
4	Vcc(56)
5	Gnd
6	–
7	–
8	Vout(5)
Configuration	**Common**
see Diagram Page 4 - 6	

FIXED LOCAL VOLTAGE REGULATOR AND SUPPLY MONITOR

ZRSM5030

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRSM5030 uses Zetex SM8 package to provide both regulator and supply monitor functions. This small outline surface mount package is ideal for applications where space saving is important.

The regulator section provides a fixed 5 volt positive output supplying load current up to 200mA. The circuit features internal current limit and thermal shutdown which makes the device almost impossible to destroy. The regulator shows performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Line and load regulation is improved compared with alternative devices.

The supply monitor provides a reset threshold of 4.3 volts and so operates as an ideal partner to the 5 volt regulator. The circuit includes a precise voltage reference and a comparator with built in hystresis to prevent erratic operation.The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the supply monitor is guaranteed with supply voltages from one volt upwards. From one volt up to the 4.3 volt threshold level the output is held low providing a power on reset function. Should the established supply voltage drop below the threshold level at any time, then the output will again pull low.

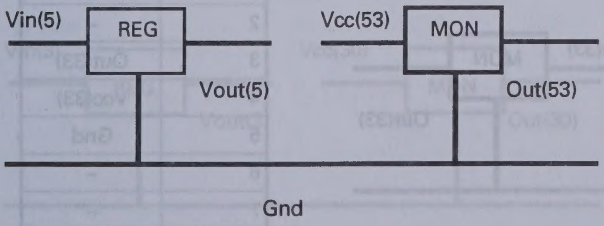
FEATURES

- Small outline SM8 package
- 5 volt, 200mA regulated output
- Low quiescent current
- Regulator internal thermal shutdown and short circuit limit
- Power on reset generation
- Automatic reset generation
- Guaranteed reset from 1 volt
- Wide input supply voltage range
- 4.3 volt monitor threshold for 5 volt logic
- Monitor internal clamp diode to discharge delay capacitor
- 20mV monitor hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



REG – 5volt regulator

MON – 4.3volt supply monitor

CONNECTION TABLE

Pin	
1	Vin(5)
2	–
3	Out(53)
4	Vcc(53)
5	Gnd
6	–
7	–
8	Vout(5)
Configuration	Common
see Diagram Page 4 - 6	

FIXED LOCAL VOLTAGE REGULATOR AND SUPPLY MONITOR

ZRSM3333

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRSM3333 uses Zetex SM8 package to provide both regulator and supply monitor functions. This small outline surface mount package is ideal for applications where space saving is important.

The regulator section provides a fixed 3.3 volt positive output supplying load current up to 200mA. The circuit features internal current limit and thermal shutdown which makes the device almost impossible to destroy. The regulator shows performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Line and load regulation is improved compared to alternative devices.

The supply monitor provides a reset threshold of 3.1 volts and so operates as an ideal partner to the 3.3 volt regulator. The circuit includes a precise voltage reference and a comparator with built in hystresis to prevent erratic operation.The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the supply monitor is guaranteed with supply voltages from one volt upwards. From one volt up to the 3.1 volt threshold level the output is held low providing a power on reset function. Should the established supply voltage drop below the threshold level at any time, then the output will again pull low.

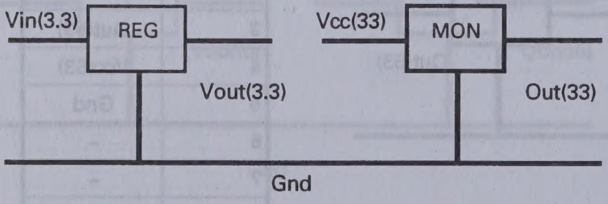
FEATURES

- Small outline SM8 package
- 3.3 volt, 200mA regulated output
- Low quiescent current
- Regulator internal thermal shutdown and short circuit limit
- Power on reset generation
- Automatic reset generation
- Guaranteed reset from 1 volt
- Wide input supply voltage range
- 3.1 volt monitor threshold for 3.3 volt logic
- Monitor internal clamp diode to discharge delay capacitor
- 20mV monitor hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



REG – 3.3 volt regulator

MON – 3.1 volt supply monitor

CONNECTION TABLE	
Pin	
1	Vin(3.3)
2	–
3	Out(33)
4	Vcc(33)
5	Gnd
6	–
7	–
8	Vout(3.3)
Configuration	**Common**
see Diagram Page 4 - 6	

FIXED LOCAL VOLTAGE REGULATOR AND SUPPLY MONITOR

ZRSM3030

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

The ZRSM3030 uses Zetex SM8 package to provide both regulator and supply monitor functions. This small outline surface mount package is ideal for applications where space saving is important.

The regulator section provides a fixed 3 volt positive output supplying a load current up to 200mA. The circuit features internal current limit and thermal shutdown which makes the device almost impossible to destroy. The regulator shows performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Line and load regulation performance is improved compared to alternative devices.

The supply monitor provides a reset threshold of 2.63volts and so operates as an ideal partner to the 3 volt regulator. The circuit includes a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the supply monitor is guaranteed with supply voltages from one volt upwards. From one volt up to the 2.63volt threshold level the output is held low providing a power on reset function. Should the established supply voltage drop below the threshold level at any time, then the output again will pull low.

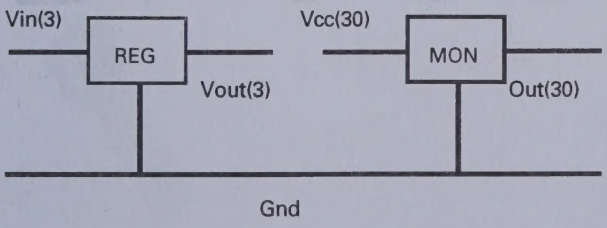
FEATURES

- Small outline SM8 package
- 3 volt, 200mA regulated output
- low quiescent current
- Regulator internal thermal shutdown and short circuit current limit
- Power on reset generation
- Automatic reset generation
- Guaranteed reset from 1 volt
- Wide input supply voltage range
- 2.63 volt monitor threshold for 3 volt logic
- Monitor internal clamp diode to discharge delay capacitor
- 20mV monitor hysteresis prevents erratic operation

APPLICATIONS

- Microprocessor systems
- Computers
- Computer peripherals
- Instrumentation
- Automotive
- Battery powered equipment

SCHEMATIC DIAGRAM



REG	3 volt regulator
MON	2.63 volt supply monitor

CONNECTION TABLE	
Pin	
1	Vin(3)
2	-
3	Out(30)
4	Vcc(30)
5	Gnd
6	–
7	–
8	Vout(3)
Configuration	**Common**
see Diagram Page 4 - 6	

FIXED LOCAL VOLTAGE REGULATOR AND SUPPLY MONITOR

ISSUE 1 - NOVEMBER 1995

DEVICE DESCRIPTION

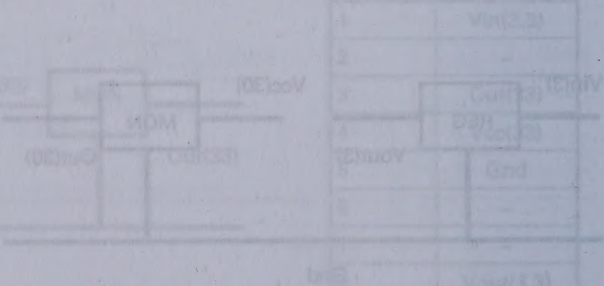
The ZRSM2030 uses Zetex SM8 package to provide both regulator and supply monitor functions. The small outline surface mount package is ideal for applications where space saving is important.

The regulator section provides a fixed 3 volt positive output supplying a load current up to 200mA. The circuit features internal current limit and thermal shutdown which makes the device almost impossible to destroy. The regulator shows performance characteristics superior to other local voltage regulators. The initial output voltage is maintained to within 2.5% with a quiescent current of typically 350µA. Line and load regulation performance is improved compared to alternative solutions.

The supply monitor provides a reset threshold of 2.63volts and so operates as an ideal partner to the 3 volt regulator. The circuit includes a precise voltage reference and a comparator with built in hysteresis to prevent erratic operation. The devices feature open collector outputs capable of sinking at least 10mA.

Operation of the supply monitor is guaranteed with supply voltages from one volt upwards. From one volt up to the 2.63volt threshold level the output is held low providing a power

SCHEMATIC DIAGRAM



REG 3 volt regulator

MON 2.63 volt supply monitor

Section 5

Application Specific Standard Products

Siren Driver IC

The ZSD100 siren driver IC is designed to operate with Zetex discrete transistors in household and automotive alarm circuits. The device is an economic replacement for dual 555 timers often used in these types of applications. The application note included describes the benefits to be gained from the superior IC and discrete component performance.

Selection guide

Part No	Supply Voltage Range (V)	Typical Supply Current		Output Current	Low Frequency Oscillator Range		Oscillator Output Frequency Range	
		Operating (mA)	*Standby* (mA)	source/sink (mA)	*Min* (Hz)	*Max* (Hz)	*Min* (Hz)	*Max* (kHz)
ZSD100	4 to 20	10	1	5	2	100	100	10

Schottky Diode Array

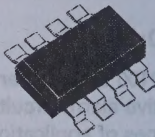
The SDA24 schottky diode array is designed to reduce reflection noise on high speed parallel data lines. 12 pairs of diodes are configured to enable clamping of transients or unwanted reflection pulses to both Vcc and ground.

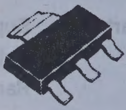
Selection guide

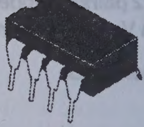
Part No	Maximum Reverse Voltage (V)	Maximum Forward Current (mA)	Forward Voltage		Maximum Reverse Current (μA)	Typical Capacitance (pF)	Typical Recovery Time (ns)
			To Vcc (V)	From Gnd (V)			
SDA24	7	50	0.85	0.75	6	6	8

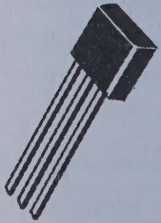
Application Specific Standard Product Ordering Information

Part Number	Package	Part Mark
ZSD100D8	DIL8	ZSD100
ZSD100N8	SO8	ZSD100
SDA24	SO16N	SDA24



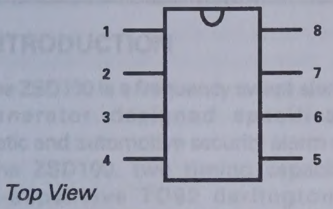




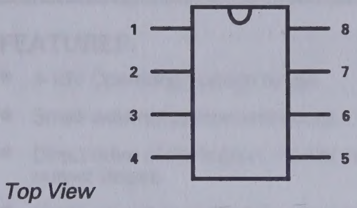


Application Specific Standard Product Connection Diagrams

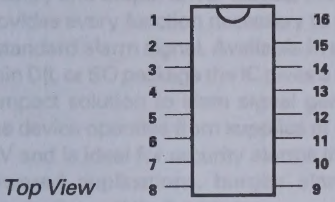
SO8 Package Suffix – N8


1
2
3
4
8
7
6
5
Top View

DIL8 Package Suffix – D8


1
2
3
4
8
7
6
5
Top View

SO16N Package Suffix – None


1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9
Top View

AUTOMOTIVE AND HOUSEHOLD SECURITY SIREN DRIVER

ZSD100

ISSUE 5 – AUGUST 1995

INTRODUCTION

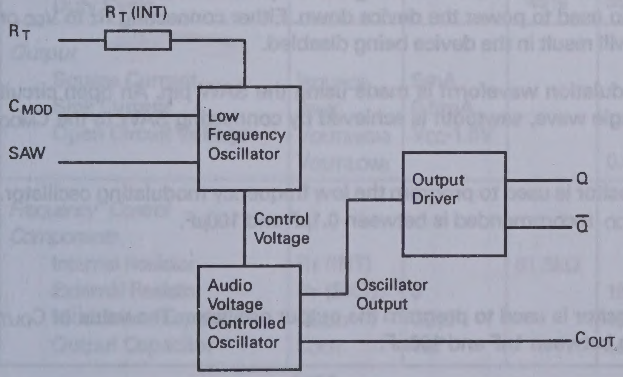
The ZSD100 is a frequency swept alarm signal generator designed specifically for static and automotive security alarm systems. One ZSD100, two timing capacitors, an in-expensive TO92 darlington, piezo transducer and coupling transformer is all that is necessary to produce an ear piercing 120 dB alarm siren.

Including an audio frequency signal generator, low frequency sweep generator, disable circuitry and output driver stages, the ZSD100 provides every function necessary to produce a standard alarm signal. Available in either an 8 pin DIL or SO package the IC gives a low cost compact solution to siren signal generation. The device operates from supplies of 4V up to 18V and is ideal for security alarms in battery powered applications, burglar alarms and automotive anti theft systems.

FEATURES

- 4-18V Operating voltage range.
- Small external component count.
- Direct drive of darlington, mosfet and IGBT output stages.
- Single ended or push-pull output stages.
- Suitable for automotive and static alarm systems.
- Low supply current - 10mA operating
  - 1µA sleep mode
- Low cost 8 pin DIL & SO packages.
- User selected audio and sweep frequencies.
- -40°C to 125°C operating temperature range.
- Choice of modulation waveform.

SCHEMATIC DIAGRAM



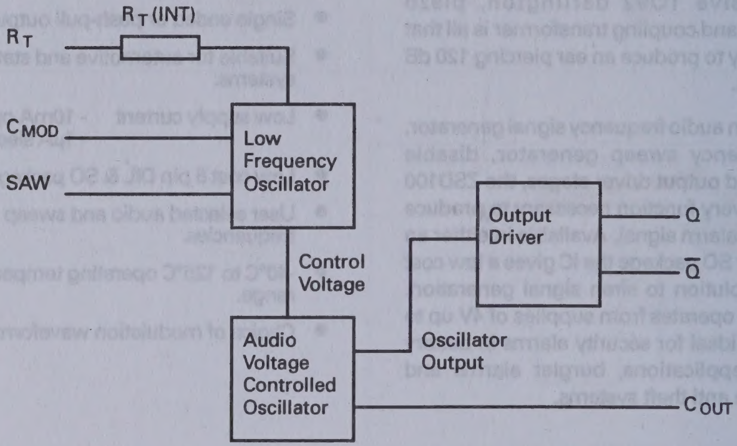
CONNECTION TABLE

Pin	SO8	DIL8
1	R_T	R_T
2	SAW	SAW
3	C_{MOD}	C_{MOD}
4	GND	GND
5	C_{OUT}	C_{OUT}
6	Q	Q
7	$\overline{Q}$	$\overline{Q}$
8	V_{CC}	V_{CC}
Pack	N8	D8

see Diagrams Page 5 - 3

FUNCTIONAL DESCRIPTION

The audio signal of the ZSD100 is generated using a squarewave oscillator whose output is capable of directly driving a wide range of output circuits. To produce a characteristic alarm siren sound, the frequency of the audio oscillator is swept over a fixed 2:1 range by a second, low frequency oscillator. The freqencies of both oscillators are controlled by R_T(INT) and capacitors C_{MOD} and C_{OUT}.



R_T
R_T(INT)
C_{MOD}
SAW
Low Frequency Oscillator
Control Voltage
Audio Voltage Controlled Oscillator
Oscillator Output
Output Driver
Q
$\overline{Q}$
C_{OUT}

PIN DESCRIPTIONS

1.	R_T	Optional external resistor for improved frequency control. An external resistor improves the control of both the modulating and output oscillators. The R_T pin is also used to power the device down. Either connecting R_T to V_{CC} or an open circuit will result in the device being disabled.
2.	SAW	Selection of modulation waveform is made using the SAW pin. An open circuit produces a triangle wave, sawtooth is achieved by connecting SAW to the C_{MOD} pin.
3.	C_{MOD}	An external capacitor is used to program the low frequency modulating oscillator. The value of C_{MOD} recommended is between 0.1µF and 100µF.
4.	GND	
5.	C_{OUT}	An external capacitor is used to program the output oscillator. The value of C_{OUT} recommended is between 1nF and 100nF.
6.	Q	Non inverted output driver
7.	$\overline{Q}$	Inverted output driver
8.	V_{CC}	

ABSOLUTE MAXIMUM RATING

V_{CC}	-0.5V to +20V
Operating Temperature	-40 to 125°C
Storage Temperature	-65 to 150°C

Power Dissipation (T_{amb}=25°C)

SO8	625mW
DIL8	625mW

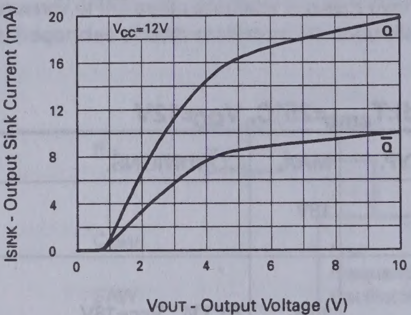
ELECTRICAL CHARACTERISTICS
TEST CONDITIONS (Unless otherwise stated):T_{amb}=25°C, V_{CC}=12V

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	CONDITIONS.
Supply Voltage Operating Range	V_{CC}	4V		18V	
Supply Current	I_{CC}				
Disabled				1μA	R_T O/C, V_{CC}=18V
Enabled				25mA	R_T, Q, $\overline{Q}$ at Gnd, V_{CC}=18V
Modulating Oscillator					
Frequency Range	F_{MOD}	0.1Hz		10Hz	V_{CC}=4 to 18V
Frequency Value	F_{MOD}	3.3Hz 5.1Hz	4.3Hz 5.5Hz	5.4Hz 5.9Hz	R_T=0, C_{MOD}=10μF R_T=470kΩ, C_{MOD}=1μF
See Note 1					
Output Oscillator					
Frequency Range	F_{OUT}	100Hz		10kHz	V_{CC}=4 to 18V
Centre Frequency (Note 2)	F_{OUT}	1.01kHz	1.26kHz	1.58kHz	R_T=0, C_{OUT}=22nF
Deviation	ΔF_{OUT}		±33%		
Duty Cycle			49%	55%	
Output					
Source Current	I_{SOURCE}	5mA			V_{OUT}=1.4V
Sink Current	I_{SINK}	0.5mA			V_{OUT}=1.4V
Open Circuit Voltage	$V_{OUT(HIGH)}$	V_{CC}-1.5V			I_{OUT}=100μA
	$V_{OUT(LOW)}$			0.5V	I_{SINK}=0.1μA
Frequency Control Components					
Internal Resistor	R_T (INT)		61.5kΩ		
External Resistor	R_T (EXT)	0		1MΩ	
Modulation Capacitor	C_{MOD}	0.1μF		100μF	
Output Capacitor	C_{OUT}	1nF		100nF	

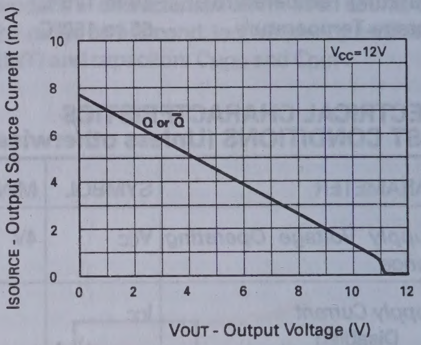
Note 1. $$F_{MOD} = \frac{2850}{C_{MOD}(61.5+R_T(EXT))} Hz$$ C_{MOD} in μF, R_T (EXT) in kΩ

Note 2. $$F_{OUT} = \frac{1710}{C_{OUT}(61.5+R_T(EXT))} kHz$$ C_{OUT} in μF, R_T (EXT) in kΩ

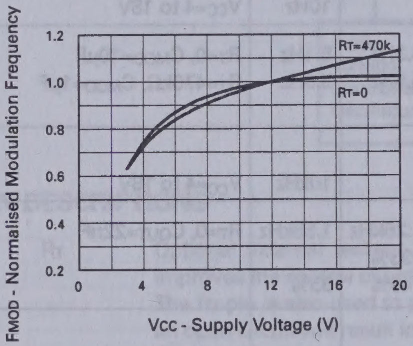
TYPICAL CHARACTERISTICS



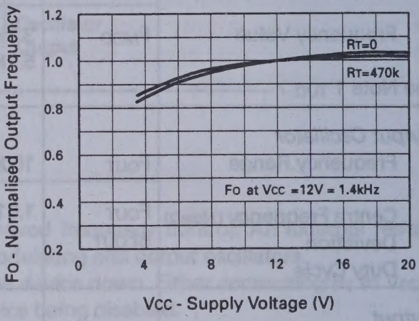
ISINK vVOUT



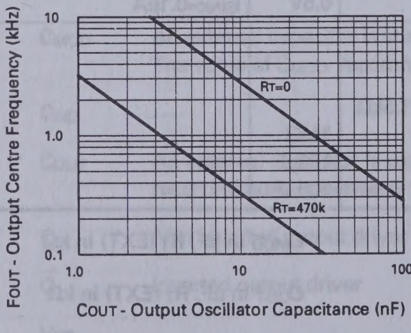
ISOURCE vVOUT



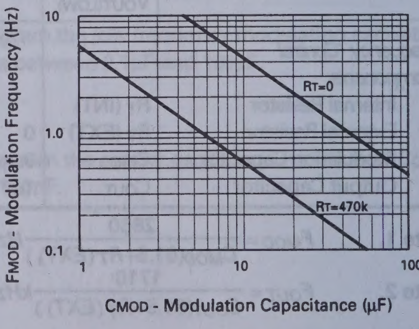
FMOD vVCC



FO vVCC

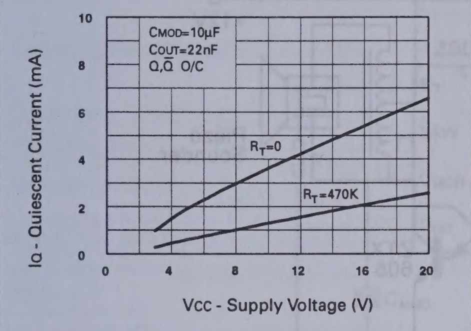


FOUT vCOUT

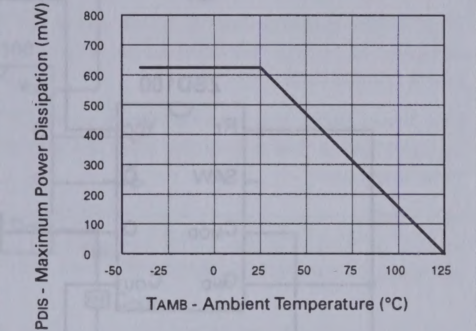


FMOD v CMOD

TYPICAL CHARACTERISTICS



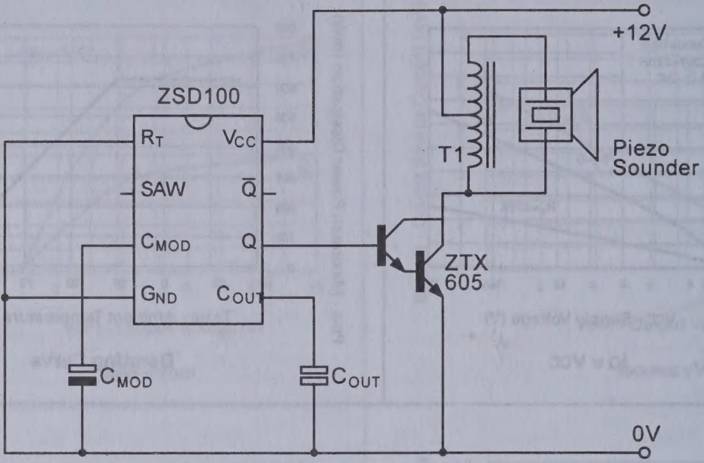
IQ v VCC



Derating Curve

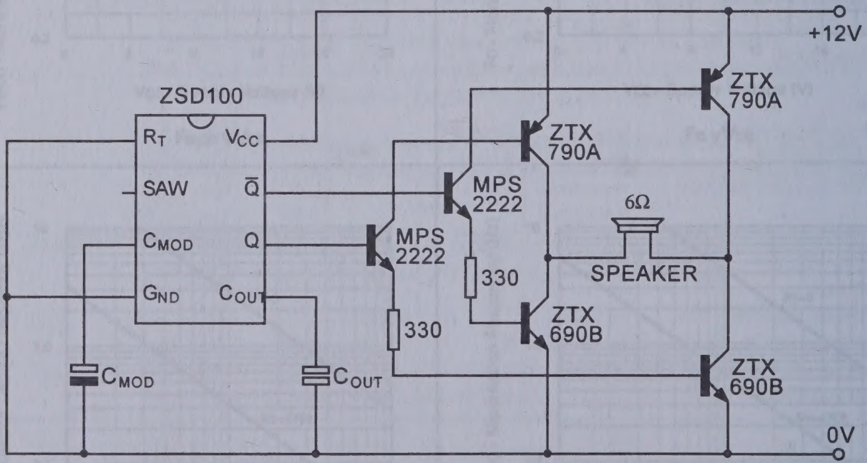
APPLICATIONS CIRCUITS

Piezo Sounder


ZSD100
RT
VCC
SAW
Q̄
CMOD
Q
GND
COUT
+12V
T1
Piezo Sounder
ZTX 605
CMOD
COUT
0V

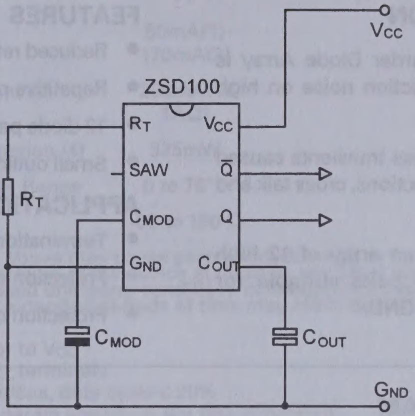
Utilizing a standard autotransformer driven piezo sounder, this circuit indicates a minimum component count alarm solution. In this configuration a ZTX605 darlington transistor can be connected directly to the ouput of the IC without the need for base resistors.

Moving Coil Loudspeaker Sounder


ZSD100
RT
VCC
SAW
Q̄
CMOD
Q
GND
COUT
+12V
ZTX 790A
ZTX 790A
MPS 2222
MPS 2222
6Ω
SPEAKER
330
330
ZTX 690B
ZTX 690B
CMOD
COUT
0V

Moving coil loudspeakers are often used for the very highest output automotive alarm sounders. The ZSD100 complementary outputs, with the selection of ZTX790A and ZTX690B transistors, can drive this H bridge ouput circuit without any additional interface components.

Improved Frequency Control

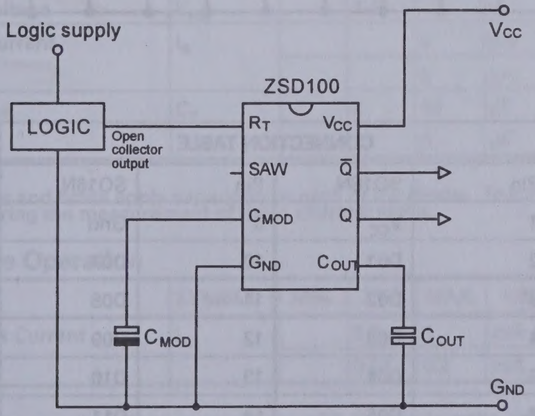

ZSD100
RT
VCC
SAW
Q̄
CMOD
Q
GND
COUT
RT
VCC
CMOD
COUT
GND

Improved frequency control can be achieved with an external resistor between the RT pin and GND. An external resistor reduces the value of the timing capacitors required for the selected operating frequency and also reduces the ZSD100's power consumption.

Note: The outputs of the ZSD100 have been designed to avoid cross-conduction in full bridge output circuits. Large value external timing resistors can lead to a small level of cross-conduction. It is recommended that external timing resistors are not used with bridge output circuits.

Remote Switching

If the RT pin is switched open-circuit, all internal functions of the IC are shut down.


Logic supply
LOGIC
Open collector output
ZSD100
RT
VCC
SAW
Q̄
CMOD
Q
GND
COUT
VCC
CMOD
COUT
GND

Note: A small leakage current in the open collector logic controller will enable the IC. If such leakage cannot be eliminated, its effect can be easily negated by adding a high value resistor (eg. 100k) between pin RT and VCC. This resistor will have no effect on frequency control.

SCHOTTKY DIODE ARRAY

SDA24

ISSUE 2 – SEPTEMBER 1994

DEVICE DESCRIPTION

The SDA24 Schottky Barrier Diode Array is designed to reduce reflection noise on high speed parallel data lines.

The device helps suppress transients caused by transmission line reflections, cross talk and switching noise.

The SDA24 consists of an array of 12 high speed Schottky diode pairs suitable for clamping to V_{CC} and / or GND.

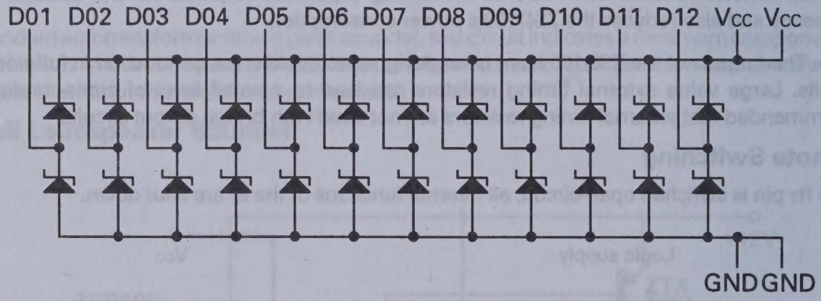
FEATURES

- Reduced reflection noise
- Repetitive peak forward current - 200mA
- 12 diode pairs
- Small outline package

APPLICATIONS

- Termination of data lines
- Protection of memory devices
- Protection of clock lines

SCHEMATIC DIAGRAM



CONNECTION TABLE			
Pin	SO16N	Pin	SO16N
1	V_{CC}	9	Gnd
2	D01	10	D07
3	D02	11	D08
4	D03	12	D09
5	D04	13	D10
6	D05	14	D11
7	D06	15	D12
8	G_{nd}	16	VCC

See Diagrams Page 5 - 3

ABSOLUTES MAXIMUM RATING (at T_{amb}=25°C unless otherwise stated)*

Steady-State Reverse Voltage	7V
Continuous Forward Current	50mA(1) 170mA(2)
Repetitive Peak Forward Current (3)	200mA(1) 1A(2)
Continuous Total Power Dissipation (4)	325mW
Operating Free-air Temperature Range	0 to 70°C
Storage Temperature Range	-65 to 150°C

* Stresses beyond those listed above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under the recommended operating conditions is not implied. Exposure to absolute maximum rated conditions for extended periods of time may affect device reliability.

Note:

(1) Any D terminal from GND or to V_{CC}
(2) Total through all GND or V_{CC} terminals
(3) These values apply for t_W=100µs, duty cycle ≤ 20%
(4) For operation above 25°C , derate linearly at the rate of 5mW/°C

ELECTRICAL CHARACTERISTICS (at T_{amb}=25°C unless otherwise stated)

Single-Diode Operation

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Static Forward Voltage	V_F		0.85	1.05	V	To V_{CC} , I_F=18mA
			1.05	1.3	V	To V_{CC} , I_F=50mA
			0.75	0.95	V	From GND, I_F=18mA
			0.95	1.2	V	From GND, I_F=50mA
Peak Forward Voltage	V_{FM}		1.45		V	I_F=200mA
Static Reverse Current	I_R			6	µA	To V_{CC} ,V_R=7V
				5	µA	From GND, V_R=7V
Total Capacitance	C_T		6	16	pF	V_R=0, f=1MHz
			4	6	pF	V_R=2V, f=1MHz

Note:

(5) Test conditions and limits apply separately to each of the diodes. The diodes not under test are open circuited during the measurement of these characteristics.

Multiple-Diode Operation

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Internal Crosstalk Current	I_X		0.8	2	mA	Total I_F=1A (6)
			0.02	0.2	mA	Total I_F=198mA (6)

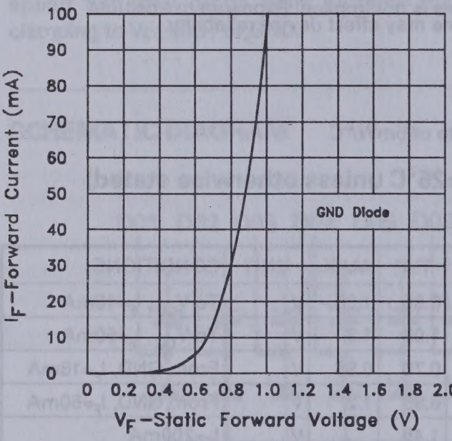
Note:

(6) I_X is measured under the following conditions with one diode static, and all others switching. Switching diodes: t_W=100µs, duty cycle=0.2; static diode; V_R=5V. The static diode input current is the internal crosstalk current I_X.

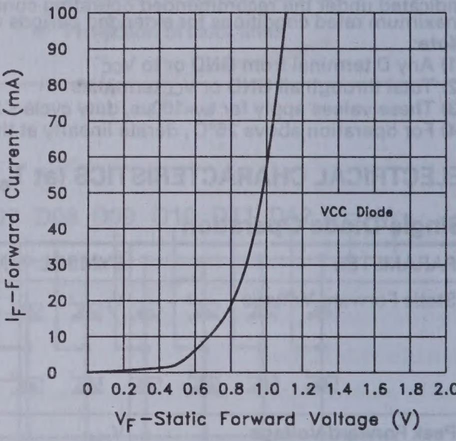
SWITCHING CHARACTERISTICS (over operating free-air temperature range)

PARAMETER	SYMBOL	MIN.	TYP.	MAX	UNIT	CONDITIONS
Reverse Recovery Time	t_{rr}		8	16	ns	I_F=10mA $I_{R(REC)}$=1mA $I_{RM(REC)}$=10mA R_L=100Ω

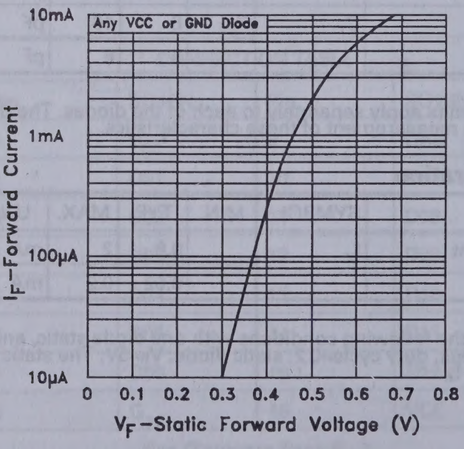
TYPICAL CHARACTERISTICS



I_F vs V_F Characteristic



I_F vs V_F Characteristic



Low I_F vs V_F Characteristic

ZETEX
Applications Note 16[1]
Issue 1 June 1995

Automotive and Household Siren Driver Circuits

Many of today's modern alarm systems employ a moving coil loudspeaker as the siren element. The usual circuits used to interface between the alarm system's processing unit and the speaker consists of a signal generation IC and a discrete H-bridge.

The signal generation circuit is often built around standard 555 timers, although other systems may use discrete transistor circuits, op-amp derived circuits or even small microcontrollers. The 555 configuration will consist of a slow running astable multivibrator, generating a ramp signal, which modulates a second multivibrator causing it to sweep over a range of frequencies.

The drive circuit usually employs TO126 or TO220 packaged power transistors, since the currents involved and the resulting power dissipation are both in excess of common smaller packaged products. The devices used normally require parallel collector emitter diodes, to divert destructive reverse transients generated by the inductive load, and base emitter resistors to provide a path for any transistor leakage current. This factor is particularly important with usual TO126/TO220 products as their poor $V_{CE(sat)}$ performance can lead to a significant temperature rise. Some circuits use Darlington TO220's which can reduce the component count if the devices include integral collector emitter

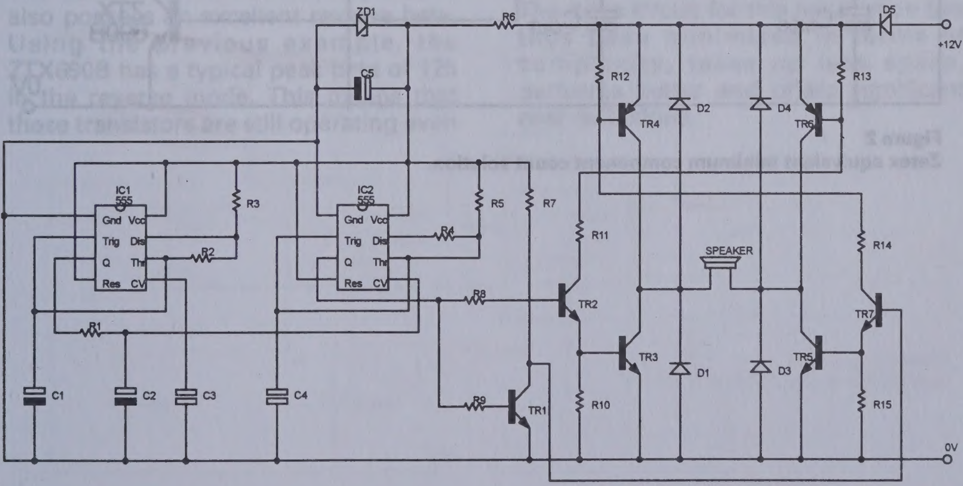


Figure 1.
Typical circuit based on 555 configuration

---

[1] This application note has been taken from the Zetex Applications book which is currently in production and will be released early 1996

diodes. However, the Darlington configuration produces a high on-state voltage which causes excess dissipation. This type of circuit requires base emitter resistors and also reduces the power delivered to the load.

The result of the above is a complex circuit, with a high component count, requiring excessive board space and a consequential high cost. Fig 1 indicates a typical, and complex, solution to the circuits described above.

Zetex total siren driver solution addresses all these problems in one by utilising a custom designed ASIC, which has a minimal pin count and uses few external components, and the superior performance of its discrete transistors. The result is a low cost, minimum component count solution which still maintains the performance advantages expected from a Zetex product. Fig 2 shows the Zetex circuit solution equivalent to that shown in Fig 1.

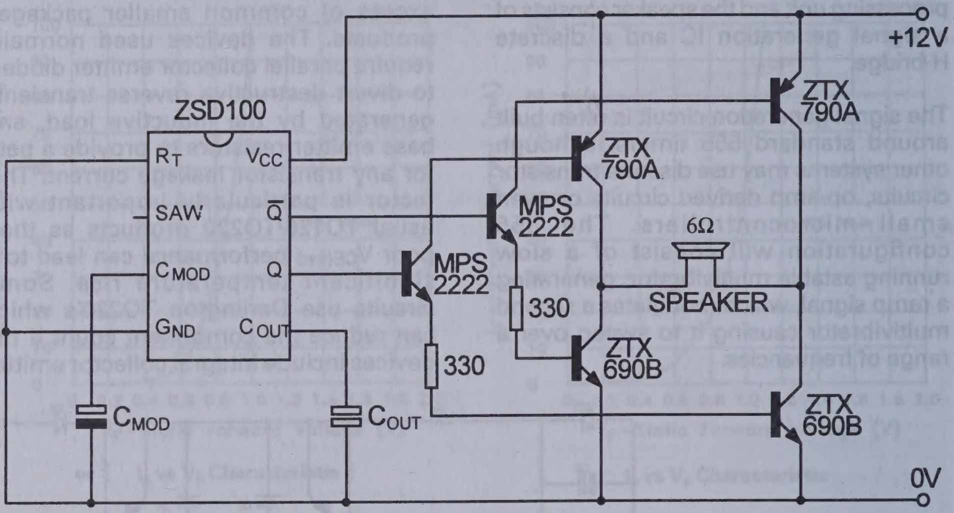

ZSD100
R_T
V_{CC}
$\overline{SAW}$
$\overline{Q}$
C_{MOD}
Q
G_{ND}
C_{OUT}
C_{MOD}
C_{OUT}
MPS 2222
MPS 2222
330
330
ZTX 790A
ZTX 790A
ZTX 690B
ZTX 690B
6Ω
SPEAKER
+12V
0V

Figure 2
Zetex equivalent minimum component count solution.

H-bridge circuits

Zetex recommend the use of their Super E-line transistors in this application. These TO92 style components have three important features which are exploited in addressing the problems described above.

Zetex discrete transistors use an exceptionally efficient matrix die geometry to achieve very low saturation voltages, $V_{CE(sat)}$, which is ideal for high current switching applications. This means for the typical operating currents required, normally in the region of 2A, there is very low dissipation and therefore minimal temperature rise. For example the ZTX690B devices shown in the diagram, with I_C=2A and I_B=20mA have a saturation voltage of only 300mV.This performance factor means that the need to divert leakage currents at high temperatures is removed and so the usual base emitter resistors are no longer required. This may be particularly important in automotive applications where the operating environment can produce very high temperatures.

The devices chosen for this application also possess an excellent reverse beta. Using the previous example, the ZTX690B has a typical peak beta of 125 in the reverse mode. This means that these transistors are still operating even with reverse transients such as those generated when driving an inductive load. The benefit of this is that for siren driving applications the need for collector emitter protection diodes is removed.

A further benefit of the transistor matrix design and low saturation voltage is that the devices can be housed in a very small package. The Zetex E-line package is smaller than a TO92 yet the performance of the devices matches that of similar TO126 and TO220 components. The result of this is equivalent or superior performance within a much smaller space.

The circuit shown in Fig 2 has been designed to operate with a 6 ohm load impedance or higher. If a lower load impedance is required, say 4 ohms, then changing the transistors to a selection from the ZTX850 and ZTX950 series will provide up to 5 amps drive current.

The circuit we have shown has been tested and is 98.5% efficient- the resultant siren produces more than an ear piercing 120dB output.

The drive circuit for this application has thus been minimised in terms of complexity, takes up less space, performs better and offers significant cost reductions.

ZSD100 Siren Driver ASIC

The ZSD100 is a linear bipolar ASIC designed specifically to complement the drive circuits described above. The device utilises an 8 pin dual in line package and a minimum number of external components to generate a frequency swept signal suitable for either static or automotive security alarm systems. Fig 3 shows a schematic of the device.

As with other circuit approaches the device consists of a low frequency oscillator, which generates a control voltage to modulate the on-board voltage controlled oscillator.

The output stage of the device consists of a complementary driver which works equally well whether driving MOSFET's or IGBT's as alternatives to the bipolar transistor circuits shown. The output configuration enables not only the drive requirements required for full bridge circuits, as described above, but also single ended drive circuits such as would be required for piezo transducers, the other popular alarm sound generating device. This circuit is shown in Fig 4.

The frequency programming of the device can be achieved with only two capacitors, although an extra pin is provided which provides improved control of the both the low and high frequency oscillators if an external resistor is used, see Fig 5. Selection of the appropriate capacitors gives a low frequency sweep in the range 0.1 to 10Hz and an output frequency modulated between 100Hz and 10KHz.

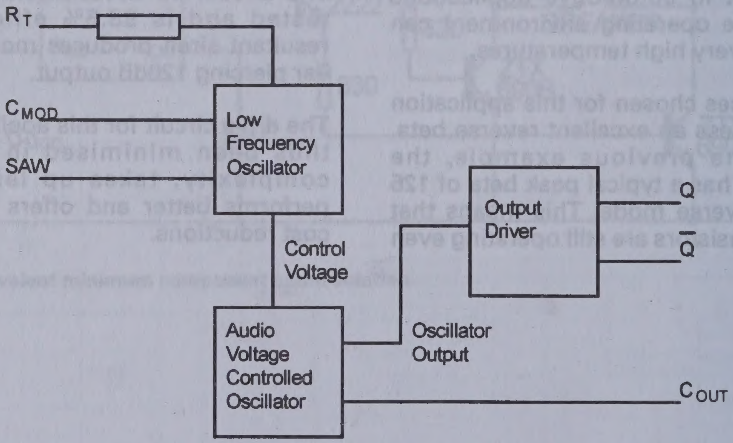
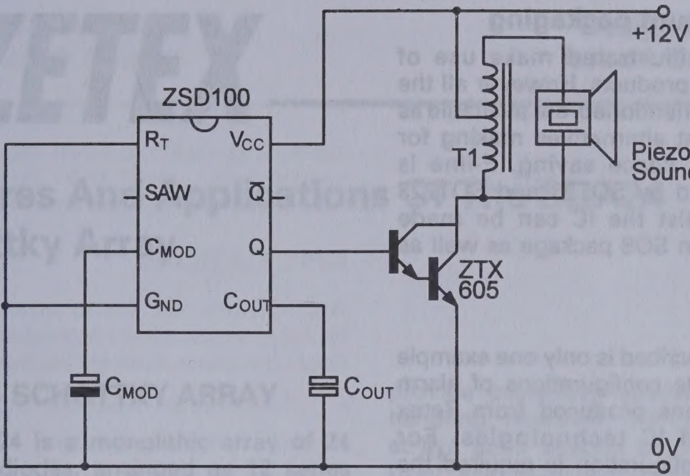


Figure 3
Schematic of the ZSD100



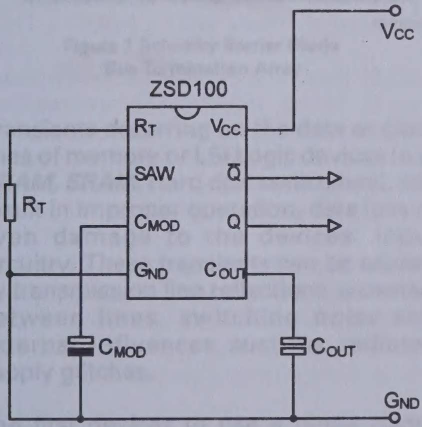
ZSD100
RT
VCC
SAW
Q̄
CMOD
Q
GND
COUT
CMOD
COUT
+12V
T1
Piezo Sounder
ZTX 605
0V

Figure 4
Single ended drive circuit for piezo sounders.

The external resistor pin can also perform another function in that if it is driven from a logic source, which could be the alarm microprocessor, it can act as a disable by inhibiting all the driver functions, Fig 6.

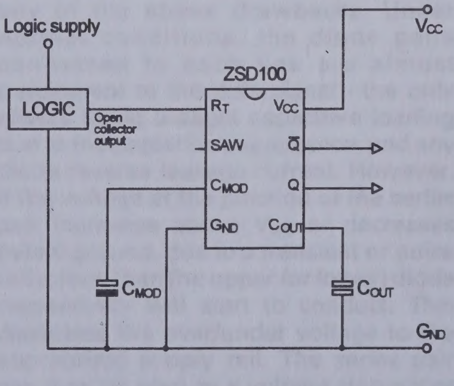
One further feature of the ASIC is that the modulation waveform can be simply selected as either ramp or sawtooth, by using the SAW pin, giving variety in the properties of the siren output waveform.

With battery operation in mind the IC can operate from 4 up to 18 volts consuming only 1µA in sleep mode. Another power saving property of the IC is the built in anti cross-conduction delay which, in full bridge circuits, prevents both arms of the bridge conducting simultaneously.



VCC
ZSD100
RT
VCC
SAW
Q̄
RT
CMOD
Q
GND
COUT
CMOD
COUT
GND

Figure 5
Improved frequency control.



Logic supply
LOGIC
Open collector output
VCC
ZSD100
RT
VCC
SAW
Q̄
CMOD
Q
GND
COUT
CMOD
COUT
GND

Figure 6
Logic controlled inhibit.

Surface mount packaging

The circuits illustrated make use of through hole products. However all the components mentioned are available as surface mount alternatives making for even greater space saving. E-line is complemented by SOT23 and SOT223 products whilst the IC can be made available in an SO8 package as well as the DIL8.

Summary

The circuit described is only one example of the possible configurations of alarm circuit solutions produced from Zetex discrete and IC technologies. For whichever configuration is required the Zetex solution will offer reduced component count, space saving and cost saving whilst maintaining superior performance.

If you would like to try the circuit in your own application then a call to Zetex local office will assist you in sourcing a demonstration board which includes a ZSD100 and an output bridge configuration.

ZETEX

Design Note DN23[1]
Issue 1 October 1995

Features And Applications Of The SDA24 Schottky Array

SDA24 - SCHOTTKY ARRAY

The SDA24 is a monolithic array of 24 schottky diodes, arranged as 12 series pairs. The diode array appears schematically in Fig. 1 below. In practice the cathodes are commoned together and connected to the positive rail, (Vcc) in the system; the commoned anodes being connected to ground. Each data line is then connected to the mid point of each series pair.

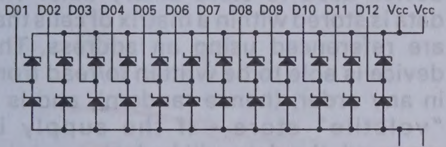


Figure 1 Schottky Barrier Diode Bus Termination Array

Transients occurring on the data or clock lines of memory or LSI Logic devices (e.g. ***DRAM, SRAM***, Hard disc controllers), can result in improper operation, data loss or even damage to the devices' input circuitry. These transients can be caused by transmission line reflections, crosstalk between lines, switching noise and external influences such as radiated supply glitches.

The first devices to use a diode clamp were CMOS logic gates, in order to provide protection against ESD during handling. However, the use of schottky arrays goes beyond protection and so they are referred to as ***Termination Arrays***. Transmission lines operating at high speed require effective terminations, otherwise, the reflections created on the line would corrupt the data signals and necessitate re-transmission. Transmission line theory states that a terminating resistance, equal to the characteristic impedance of the line should be used to provide a perfect match. In practice however, use of resistive termination networks in digital systems can lead to an increased power consumption, inferior noise immunity and, for some networks increased propagation delays.

Schottky diode arrays do not suffer from any of the above drawbacks. Under normal conditions, the diode pairs connected to each line are almost transparent to the data signal - the only effects being a slight capacitive loading due to the depletion capacitance, and any diode reverse leakage current. However, if the voltage at the junction of the series pair increases above V_{CC} or decreases below ground, due to a transient or pulse reflection, then the upper (or lower) diode respectively will start to conduct. This dissipates the over/under voltage to the appropriate supply rail. The series pair can then be seen as a voltage clamp that is effective at a Vf above and below the

---

[1] This Design Note has been taken from the Zetex Applications Book which is currently in production and will be released early 1996

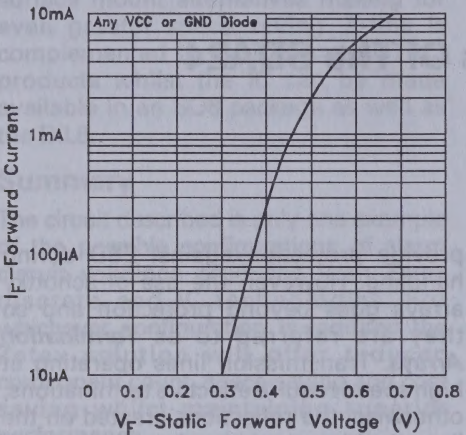


Figure 2. Low I_F vs V_F Characteristic

supply rail. For example on a 5V supply, each schottky pair will contain the data signal within a 5V + Vf and 0V-Vf window, where the Vf will be typically 0.4V at low currents. (please refer to figure 2).

The waveforms in Figure 3 illustrate this action, and were produced by driving a 10M length of typical digital comms coaxial cable. The effect of voltage clamping can be seen on the first overshoot, and the subsequent reflections are reduced almost to zero.

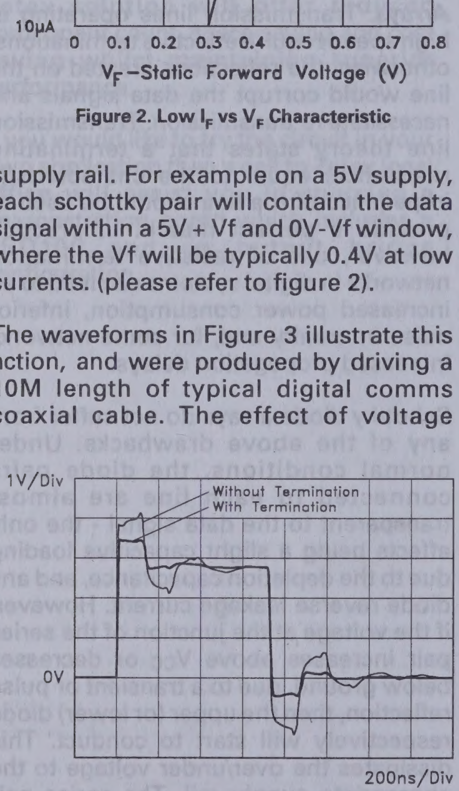


Figure3. Example Scope Display
Effect of Terminating Schottky pair on a pulse transmission

APPLICATIONS

Applications for these arrays can be found in areas where high speed parallel data communication is required such as:

- Termination networks
- Network peripherals
- Hard disc drives
- CD ROM drives
- Floptical Drives
- DAT drives
- Disc arrays

GLOSSARY

RAM-Random Access Memory - an LSI device used to store binary data. The data is stored within a matrix of cells that are referenced using an address. The device is able to be written to/read from in any order, (hence random), and is a "volatile" store - if the supply is removed, the data will be lost.

DRAM-Dynamic RAM - this form of RAM needs to be continually refreshed, otherwise the data will be lost, and so requires an additional refresh controller, though some microprocessors supply this function automatically.

SRAM-Static RAM - this doesn't require a refresh function as does dynamic RAM. It will store data written to it until it is changed by the system or lost by a power loss or shut down.

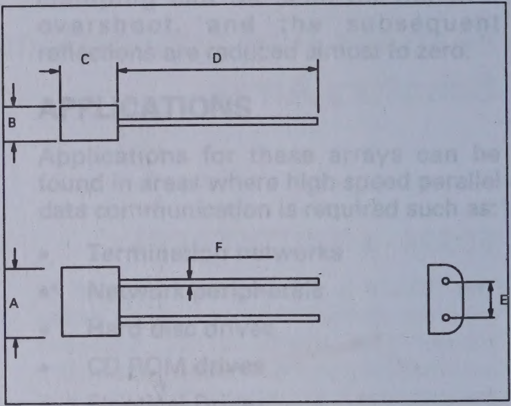
CROSSTALK-The noise or signal leaked or induced from one circuit, bus or IC section to another.

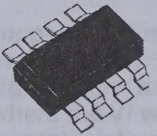
Section 6
Packaging Information

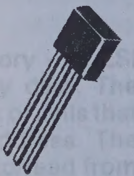
PACKAGING DIMENSIONS - THROUGH HOLE

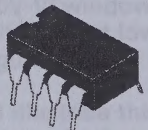
2 pin E-Line

DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	4.37	4.77	0.172	0.188
B	2.16	2.41	0.085	0.095
C	3.61	4.01	0.142	0.158
D	13.00	13.97	0.512	0.550
E	NOM 2.54		NOM 0.10	
F	0.41	0.495	0.016	0.0195



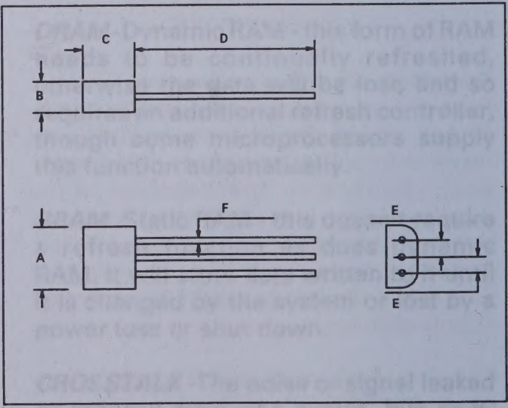






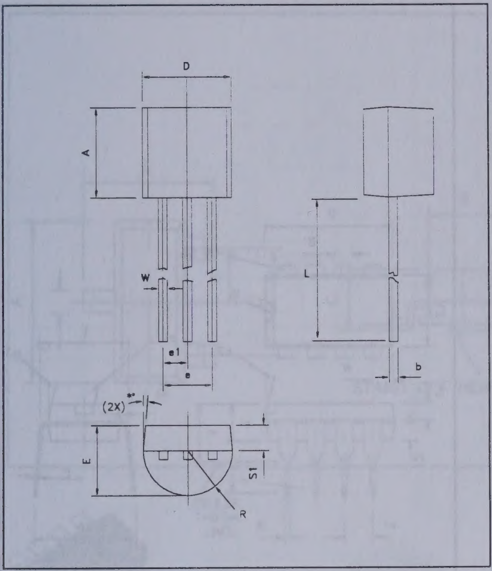
3 pin E-Line

DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	4.37	4.77	0.172	0.188
B	2.16	2.41	0.085	0.095
C	3.61	4.01	0.142	0.158
D	13.00	13.97	0.512	0.550
E	NOM 1.27		NOM 0.05	
F	0.41	0.495	0.016	0.0195

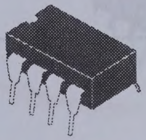


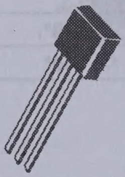
PACKAGING DIMENSIONS - THROUGH HOLE(Continued)

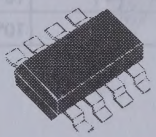
TO92



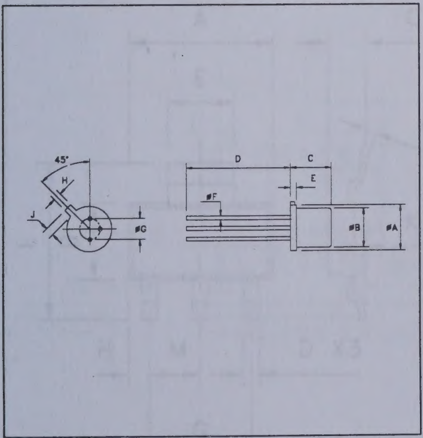
DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	4.32	4.95	0.170	0.195
b	0.36	0.51	0.014	0.020
E	3.30	3.94	0.130	0.155
e	2.41	2.67	0.095	0.105
e1	1.14	1.40	0.045	0.055
L	12.70	15.49	0.500	0.610
R	2.16	2.41	0.085	0.095
S1	1.14	1.52	0.045	0.060
W	0.41	0.56	0.016	0.022
D	4.45	4.95	0.175	0.195
*°	4°	6°	4°	6°







TO18

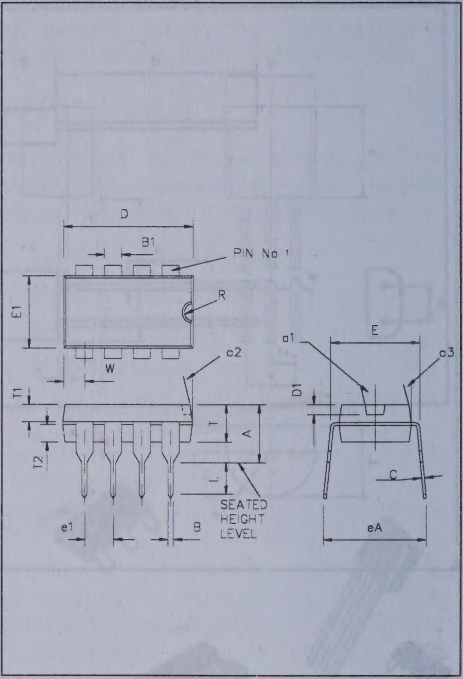


DIM	Millimetres	Inches
A	5.6	0.220
B	4.75	0.187
C	5.0	0.197
D	12.7 (Min)	0.50 (Min)
E	0.76 Max	0.03 (Max)
F	0.48	0.019
G	2.54	0.100
H	1.0	0.039
J	1.0	0.039

PACKAGING DIMENSIONS - THROUGH HOLE(Continued)

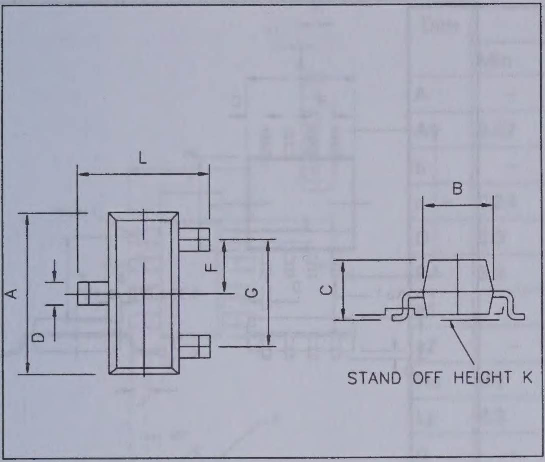
DIL8

DIM	Millimetres		Inches	
	Min	Max	Min	Max
A		4.32		0.17
B	0.46 Nom		0.018 Nom	
B1	1.52 Nom		0.06 Nom	
C	0.25 Nom		0.01 Nom	
D	8.79	8.99	0.34	0.35
D1	0.76	1.52	0.03	0.06
E	7.49	8.13	0.29	0.32
E1	6.25	6.45	0.245	0.254
eA	8.13	9.40	0.32	0.37
e1	2.54 Nom		0.1 Nom	
L	3.08	3.28	0.12	0.13
R	0.76 Nom		0.03 Nom	
T	3.20	3.40	0.126	0.134
T1	1.52 Nom		0.06 Nom	
T2	1.52 Nom		0.06 Nom	
W	0.64 Ref		0.025 Ref	
a1	4°	10°	4°	10°
a2	4°	10°	4°	10°

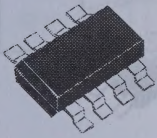

D
B1
PIN No 1
R
E1
W
a2
T1
T
A
T2
L
SEATED HEIGHT LEVEL
e1
B
a1
E
a3
D1
C
eA

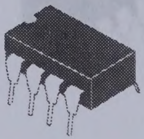
PACKAGING DIMENSIONS - SURFACE MOUNT

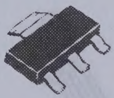
SOT23



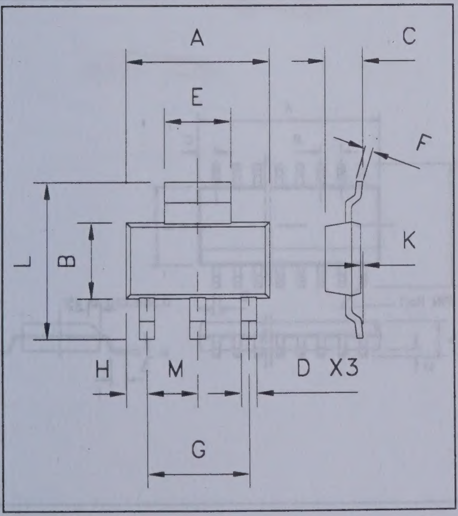
DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	2.67	3.05	0.105	0.120
B	1.20	1.40	0.047	0.055
C	–	1.10	–	0.043
D	0.37	0.53	0.0145	0.021
F	0.085	0.15	0.0033	0.0059
G	NOM 1.9		NOM 0.075	
K	0.01	0.10	0.0004	0.004
L	2.10	2.50	0.0825	0.0985







SOT223

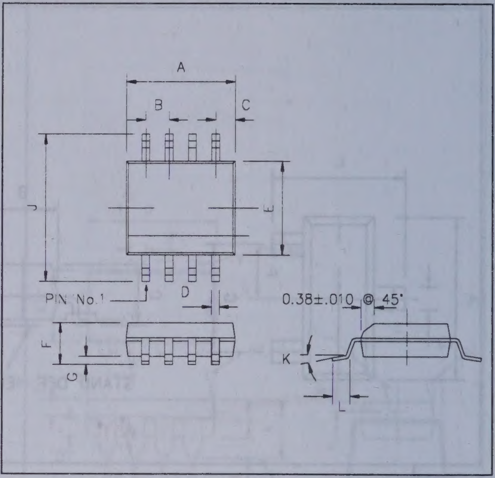


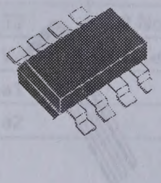
DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	6.3	6.7	0.248	0.264
B	3.3	3.7	0.130	0.146
C	–	1.7	–	0.067
D	0.6	0.8	0.024	0.031
E	2.9	3.1	0.114	0.122
F	0.24	0.32	0.009	0.013
G	NOM 4.6		NOM 0.181	
H	0.85	1.05	0.033	0.041
K	0.02	0.10	0.0008	0.004
L	6.7	7.3	0.264	0.287
M	NOM 2.3		NOM 0.0905	

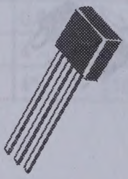
PACKAGING DIMENSIONS - SURFACE MOUNT(Continued)

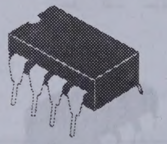
SO8

DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	4.80	4.98	0.189	0.196
B	1.27 BSC		0.05 BSC	
C	0.53 REF		0.02 REF	
D	0.36	0.46	0.014	0.018
E	3.81	3.99	0.15	0.157
F	1.35	1.75	0.05	0.07
G	0.10	0.25	0.004	0.010
J	5.80	6.20	0.23	0.24
K	0°	8°	0°	8°
L	0.41	1.27	0.016	0.050


A
B
C
J
E
PIN No.1
D
0.38±.010 @ 45°
F
G
K
L

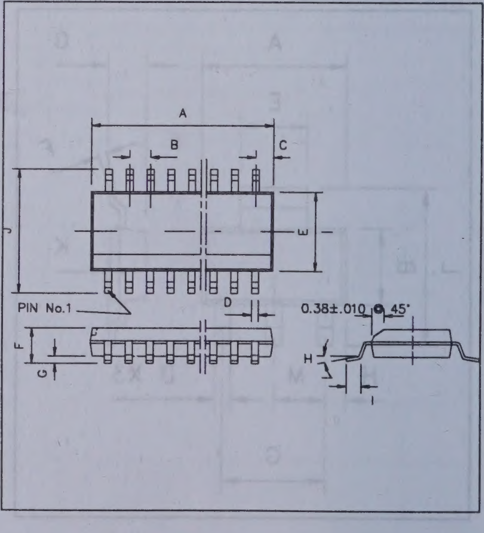






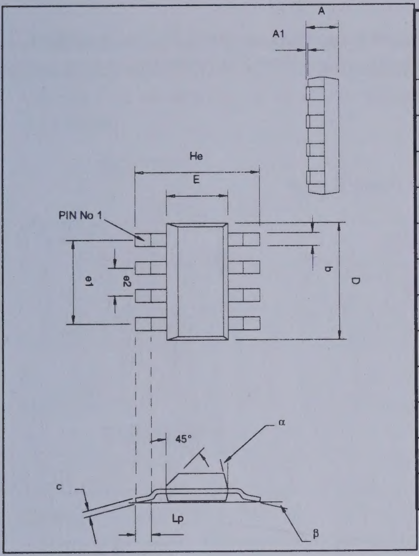
SO16N

DIM	Millimetres		Inches	
	Min	Max	Min	Max
A	9.80	9.98	0.386	0.393
B	1.27	–	0.05	–
C	0.51	–	0.02	–
D	0.36	0.46	0.014	0.018
E	3.81	3.99	0.15	0.157
F	1.35	1.75	0.053	0.069
G	0.10	0.25	0.004	0.01
H	0°	8°	0°	8°
I	0.41	1.27	0.016	0.05
J	5.80	6.20	0.23	0.244


A
B
C
J
E
PIN No.1
D
0.38±.010 @ 45°
F
G
H
I

PACKAGING DIMENSIONS - SURFACE MOUNT(Continued)

SM8


A
A1
He
E
PIN No 1
e1
e2
b
D
45°
α
c
Lp
β

Dim	Millimetres			Inches		
	Min	Typ	Max	Min	Typ	Max
A	–	–	1.7	–	–	0.067
A1	0.02	–	0.1	0.0008	–	0.004
b	–	0.7	–	–	0.028	–
c	0.24	–	0.32	0.009	–	0.013
D	6.3	–	6.7	0.248	–	0.264
E	3.3	–	3.7	0.130	–	0.145
e1	–	4.59	–	–	0.180	–
e2	–	1.53	–	–	0.060	–
He	6.7	–	7.3	0.264	–	0.287
Lp	0.9	–	–	0.035	–	–
α	–	–	15°	–	–	15°
β	–	10°	–	–	10°	–

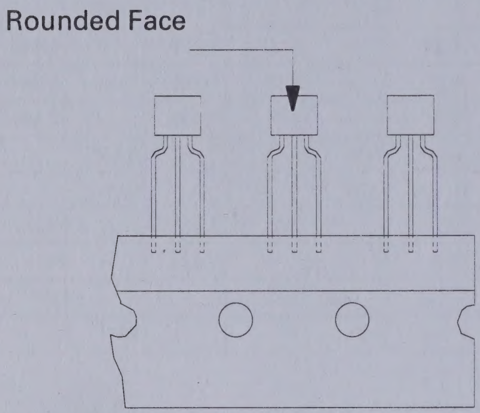
Section 7
Tape and Reel Information

Many of Zetex IC products are available with the option of tape and reeling for automatic insertion.

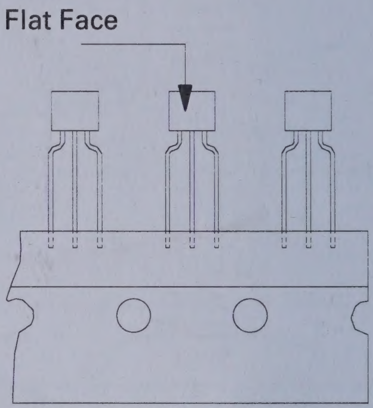
Through Hole Products

For the E-Line and TO92 devices two types of packaging are available.

1. The device is wound on a reel and supplied in a cardboard box. Two orientations are possible as represented in the following diagrams, suffixes for these options are STOA and STOB. Note that the TO92 package is only available STOB.



Option A



Option B

Package	Tape Width (mm)	Reel Size (inches)	Device per reel	Device Suffix
TO92	18	12.5	1500	STOB
E-Line	18	12.5	2000	STOA
E-Line	18	12.5	2000	STOB

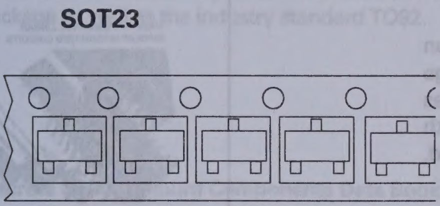
2. The device tape can be folded in a concertina form and supplied in a cardboard box, suffix for this option is STZ. Device orientation is determined by which end of the box the tape is taken from.

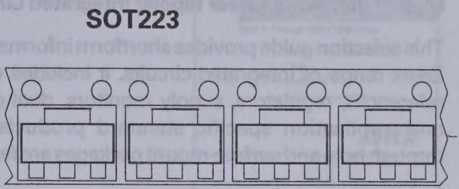
Option STZ folded tape: E-Line 2000 devices per box

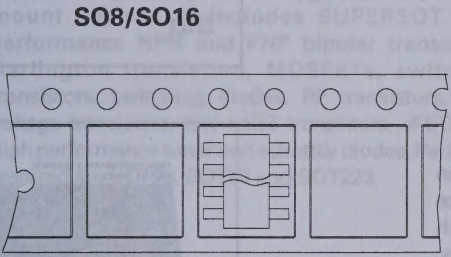
TO92 1500 devices per box

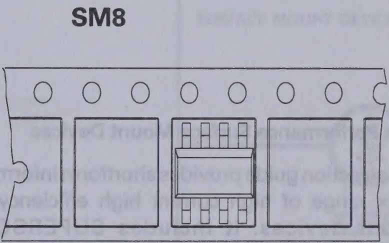
Surface Mount Products

All the surface mount devices are available with a tape and reel option. The tape conforms to both the EI481 and IEC286 industry standard taping specifications. The anti-static carrier tape holds the device in a secure cavity which is sealed with a peel-back cover tape. Reel sizes of 7" and 13" are available.









Package	Tape Width (mm)	Reel Size (inches)	Device per reel	Device Suffix
SOT23	8	7	3000	TA
SOT23	8	13	10000	TC
SOT223	12	7	1000	TA
SOT223	12	13	4000	TC
SO8 †	12	13	2500	TC
SO16 †	16	13	2500	TC
SM8	12	7	1000	TA
SM8	12	13	4000	TC

† SO8 and SO16 can be supplied in tubes.

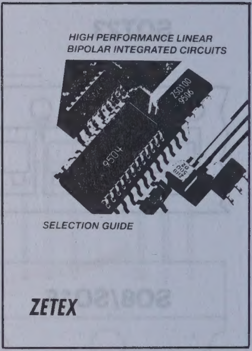
ZETEX Technical Publications

The following lists the data books available from Zetex. Please contact you local Zetex sales office for complimentary copies.

Selection guides

High Performance Linear Bipolar Integrated Circuits

This selection guide provides shortform information on Zetex range of integrated circuits. It includes voltage references, regulators, supply monitors, dual devices and application specific standard products. Both through hole and surface mount packages are featured.



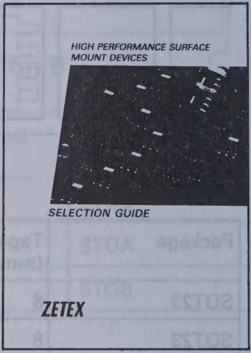
HIGH PERFORMANCE LINEAR BIPOLAR INTEGRATED CIRCUITS

SELECTION GUIDE

ZETEX

High Performance Surface Mount Devices

This selection guide provides shortform information on Zetex range of high current high efficiency surface mount devices. It includes SUPERSOT high performance NPN and PNP bipolar transistors, Darlington transistors, MOSFETs, switching transistors, switching diodes, RF transistors, high voltage transistors, low noise transistors, JFETs and high performance tuner and schottky diodes. Packages featured are SOT23, SOT89 and SOT223.



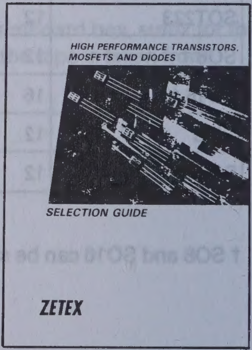
HIGH PERFORMANCE SURFACE MOUNT DEVICES

SELECTION GUIDE

ZETEX

High Performance Transistors, MOSFETs and Diodes

This selection guide provides shortform information on Zetex through hole products. It includes high performance NPN and PNP bipolar transistors, Darlington transistors, MOSFETs, switching transistors, IGBTs, switching diodes, RF transistors, low noise transistors and tuner diodes. These products feature Zetex E-Line package.



HIGH PERFORMANCE TRANSISTORS, MOSFETS AND DIODES

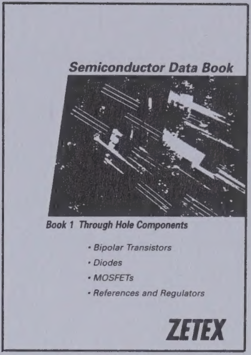
SELECTION GUIDE

ZETEX

Data Books

Discrete Through Hole Components Data Book

This data book provides full information on Zetex through hole products. It includes high performance NPN and PNP bipolar transistors, Darlington transistors, MOSFETs, switching transistors, IGBTs, switching diodes, RF transistors, low noise transistors and tuner diodes. These products feature Zetex E-Line package as well as the industry standard TO92.



Semiconductor Data Book

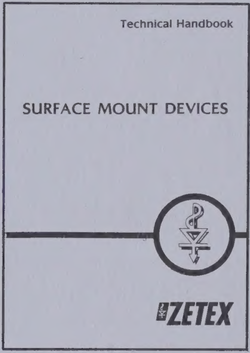
Book 1 Through Hole Components

- *Bipolar Transistors*
- *Diodes*
- *MOSFETs*
- *References and Regulators*

ZETEX

Discrete Surface Mount Components Data Book

This data book provides fully characterised information on Zetex range of high current high efficiency surface mount devices. It includes SUPERSOT high performance NPN and PNP bipolar transistors, Darlington transistors, MOSFETs, switching transistors, switching diodes, RF transistors, high voltage transistors, low noise transistors, JFETs and high performance tuner and schottky diodes. Packages featured are SOT23, SOT89 and SOT223.



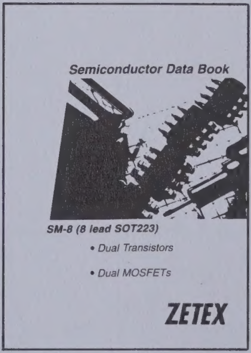
Technical Handbook

SURFACE MOUNT DEVICES

ZETEX

Discrete SM8 Products Data Book

This data book provides full information on Zetex dual devices. It includes both bipolar transistors (dual NPNs, PNPs and complementary pairs) and MOSFETs. This publication features the Zetex SM8 surface mount package.



Semiconductor Data Book

SM-8 (8 lead SOT223)

- *Dual Transistors*
- *Dual MOSFETs*

ZETEX

Applications Handbooks

Discrete Components Applications Handbook

This handbook contains a collection of application notes featuring the use of Zetex high performance discrete components.

Due For Release

Q2 1996

Zetex plc

Fields New Road, Chadderton, Oldham, OL9 8NP, United Kingdom.
Telephone: (44)161-627 5105 (Sales) (44)161-627 4963 (General Enqu
Fax: (44)161-627 5467 Internet: http://www.zetex.com

A Telemetrix PLC Group Company

Zetex GmbH

Streitfeldstraße 19
D-81673 München, Germany.
Telefon: (49) 89 45 49 49 0 Fax: (49) 89 45 49 49 49

Zetex Inc

47 Mall Drive, Unit 4, Commack NY 11725, USA.
Telephone: (516) 543 7100 Fax: (516) 864 7630

Zetex (Asia) Ltd

3510 Metroplaza, Tower 2, Hing Fong Road, Kwai Fong, Hong Kong.
Telephone: (852) 2610 0611 Fax: (852) 2425 0494

Digi-Key® CORPORATION
701 Brooks Ave. South, Thief River Falls, MN 56701
1-800-344-4539

ZETEX

© Zetex plc 1996